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An Archeological Overview of Petrified Forest National Park

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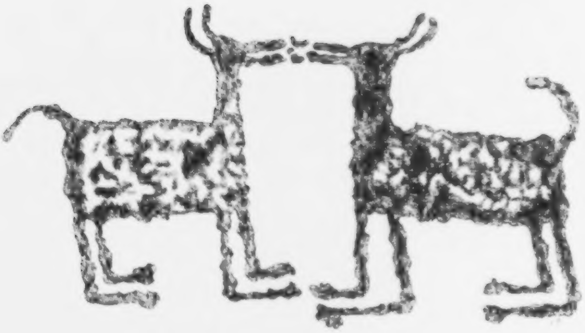
An Archeological Overview of Petrified Forest National Park

by
Yvonne G. Stewart



Publications in Anthropology No. 10

Western Archeological Center
Tucson, Arizona

1980

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National Park Service U.S. Department of the Interior

As the Nation's principal conservation agency, the Department of the Interior has the responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department also has a major responsibility for American Indian reservation communities and for people who live in island territories under United States administration.

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Acknowledgments

There are always more people to thank for their contributions to a professional report of this sort than there is room for names. My supervisor and mentor was Dr. Keith M. Anderson and the official reviewer was Dr. George J. Gumerman. David Ames, former park superintendent, and his staff were not only helpful but went out of their way to provide access to information, transportation, guides and personal knowledge; George Johnson was particularly helpful. Marsha Gallagher, Museum of Northern Arizona, helped to locate all the park collections in the midst of a major museum move. Dr. Emil Haury, Laurens Hammack and Bruce Huckell identified the pottery from Site 236. Many of the thoughts and reviews presented here were formulated on the basis of discussions with friends and professional acquaintances, particularly Patricia Gilman, Kathleen Moffitt, Lynn Teague, George Teague, Peter Pilles, Nancy Hammack and Susan Purves.

Jeanette Schloss drew the petroglyph reproductions that decorate the report just prior to her untimely death. Through the years Dianne Kay Herron, Sally Tobola and Chris Bramley deciphered my scrawl for major parts of the rough draft.

I especially want to thank John Bancroft, Brigid Sullivan and Vonna Lou Mason for work "above and beyond!" John, the editor, can make anyone's writing look good and has an extraordinary

amount of technical expertise. Brigid's drafting and graphic design are always graceful, clear and to the point. Vonna is faster and more accurate than any typist I have known. In short, all three are the very best at what they do.

Tucson, Arizona
August 1979

YGS

Foreword

Although Petrified Forest National Park was set aside as a natural park, it is an archeological gold mine, with over 300 sites recorded in the southern half alone. The sites exhibit an unbroken culture history sequence from the Archaic period until shortly before the arrival of Europeans in that part of the Southwest. They contain information about the change from hunting and gathering to agriculture, relationships between the environment and settlement pattern, relationships between major cultural areas and traditions, prehistoric farming practices and prehistoric trade.

The park is situated between three major prehistoric culture areas: the Anasazi to the north and east, the Mogollon to the south and the Sinagua to the west. It is situated between several subtraditions within these groups, such as Chaco Anasazi to the east, Kayenta Anasazi to the north and several regional variants of the Mogollon to the south and east. All of these traditions and areas have implications for the archeology of Petrified Forest, and repeated evidence of cultural blending is exhibited within entire sites, architectural units and individual artifacts.

Archeological work within the park is 30 to 40 years outdated and does not meet current needs for compliance with preservation law and policy. In particular, the data base is insufficient for planning and for determining site significance. This is not to say that previous surveys and excavations were not well done. They were very well done, sometimes excellently, and met the standards of their time.

In the last 10 years a long series of federal laws and regulations that require formal management of prehistoric and historic cultural resources within national parks has been enacted or revised. During the same period major advances in archeological strategy, method and technique have been made. Combining federal requirements, good archeology and adequate budgeting is an important problem and one that can be baffling and frustrating both for park managers and for archeologists. Both must be familiar with cultural resource laws and regulations, National Park Service policy and customary methods of implementation. Both must have a common basis to work from and common goals to achieve. The overview is designed to provide a summary of all present pertinent information for the management of the archeological resources at Petrified Forest National Park and to provide the short and long term goals necessary for combining federal compliance and good archeology. It will be the initial source of information for interpreters. It also is designed to be the initial reference for future archeologists working in or near the park, and so includes suggestions for future research directions. As such, it is not the final word on the archeology of the park, but only the first step toward that goal.

The overview was begun in 1975 and was worked on sporadically until the autumn of 1978. During the lag between writing and publication two reports that have major implications for the archeology of the park have been published or are in press. In addition to presenting a number of hypotheses that can be partially tested in the park, the first (Cordell and Plog 1979) outlines an analytical framework that should help to resolve several of the problems discussed here. The second (Hammack n.d.) is a primary report of the intensive survey of a road corridor constituting 4 percent of the land area of the park. Seventy-four sites were recorded during the 1978 and 1979 field seasons. Although all sites recorded on the survey are shown on the maps to be found in the following chapters, only those sites recorded during 1978 are discussed. Both reports should be consulted in preparation for archeological fieldwork within the park.

Chapter 1

The Environment

Environmental studies are critical to our understanding of prehistoric human populations. It is now felt that while environment does not dictate the way a group of people will live and obtain the necessities of life, it does impose limits within which the group must choose various options. This is particularly true in the arid Southwest, where many environmental areas are marginal and where group survival may depend on these choices or adaptive responses. It is impossible for an archeologist to understand completely what occurred in prehistory without a knowledge of environmental specifics for the period studied, as well as the general trends into which these specifics fit.

The Present Environment

Geography. Petrified Forest National Park covers 94,189 acres, or more than 147 square miles, in Navajo and Apache Counties, Arizona (Fig. 1). The park is located in the valley of the Puerco River. It has a generalized elevation of 5440 ft. Terrain height for 40 miles in any direction is nearly constant at 5500 to 6000 ft (Green and Sellers 1974: 340).

The park is divided into northern and southern sections joined by a narrow strip of land that crosses the Puerco River. Both ends of this strip are on a level with the surrounding high

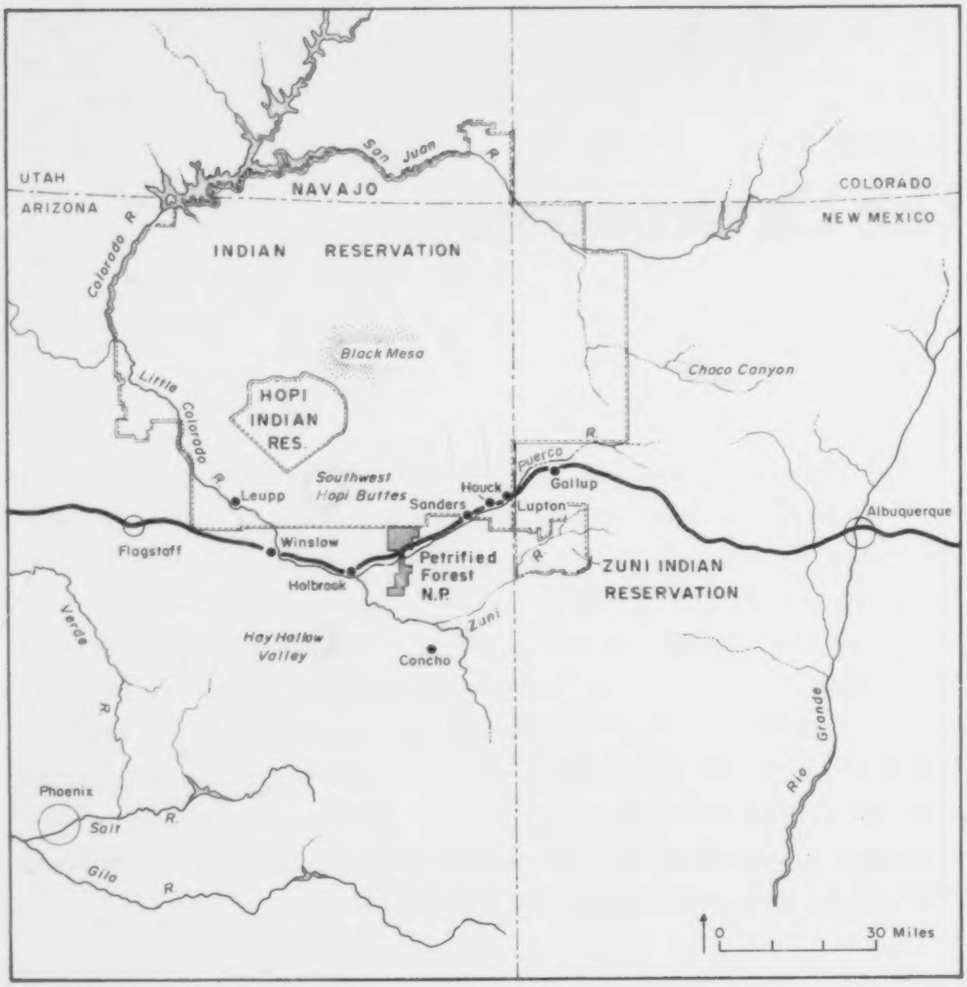
UTAH
ARIZONA
COLORADO
NEW MEXICO
NAVAJO
INDIAN RESERVATION
San Juan R.
Colorado R.
Little Colorado R.
Black Mesa
HOPI INDIAN RES.
Choco Canyon
Puerco R.
Southwest Hopi Buttes
Leupp
Houck
Sanders
Gallup
Lupton
Albuquerque
Flagstaff
Winslow
Holbrook
Petrified Forest N.P.
ZUNI INDIAN RESERVATION
R.
Zuni
Hay Hollow Valley
Concho
Verde R.
Rio Grande
Phoenix
Salt R.
Gila R.
0
30 Miles

Figure 1. Location of Petrified Forest National Park.

plateau; it drops at the center to the river terraces, floodplain and channel of the river. The two major sections generally are different, although both are dissected by large washes that give the impression of wide, steep-sided river valleys in miniature. Most of the northern section has eroded into the colorful badlands of the Painted Desert. The few roads in this section run along the escarpment that borders the desert. The southern section contains smaller badlands areas and consists primarily of mesas and plains dissected by washes.

Regional topographic descriptions and inclusions vary, but the majority of the region can be described most succinctly as a portion of the Colorado Plateau system, sometimes referred to as the High Plateau or the High Desert Plateau. The distinguishing features of the Colorado Plateau system, as listed by Fenneman (1931: 274), are the approximately horizontal orientation of its rocks, its great altitude above sea level and the remarkable development of canyons. The area, although diversified, is essentially a plateau dissected by a major stream and its tributaries (Harrell and Eckel 1939: 28). The area is visually characterized by windswept plains and mesas, isolated buttes and barren, usually dry river valleys.

Climate. The park's climate is affected significantly by the barrier of the Mogollon Plateau, primarily in amount of precipitation. Annual precipitation totals 8.64 in, about half of which occurs in the months of July, August and September, usually in the form of violent thunderstorms. The spring months are very dry, with monthly accumulations of less than one-half of one inch. A little less than half of the winter precipitation falls as snow, rarely with large accumulations.

The park has chilly winters and mild summers. Typical midwinter temperatures range from the low 20s to the upper 40s within a day. Subzero minima occur about twice a year. The typical summer temperature range is from the mid 60s to the low 90s. On in-frequent occasions the temperature may rise to the low 100s, but it has never exceeded 104°F (Green and Sellards 1974: 370). The average length of the growing season is 180 days (Smith 1945). Driving winds out of the southwest are prevalent in the spring. The winds, with gusts to 85 miles per hour, can be of such duration that they cause work stoppage (DOI 1974; Schroeder 1961).

Vegetation. Three natural plant communities (biomes)--Great Basin desertscrub, plains grassland and juniper-pinyon woodland--have been identified and photogrammetrically mapped within the park (Fig. 2). Much of the land is barren. As can be seen by comparison of Fig. 2 and the following descriptions of typical plant associations within the communities, a mixing of community associations has occurred.

Within the Great Basin desertscrub biome the dominant vegetation is short shrubs and grasses. This community is characterized by a relatively low species diversity. It has specializations for both salt and the cold.

Major shrubs are shadscale (*Atriplex confertifolia*), Mormon tea (*Ephedra viridis*), sagebrush (*Artemisia tridentata*), black brush (*Coleogyne ramosissima*) and greasewood (*Sarcobatus vermiculatus*). Occasionally important in certain areas are black sagebrush (*Artemesia nova*), rabbitbrush (*Chrysothamnus nauseosus*), plateau yucca (*Yucca angustissima*), desert olive (*Forestiers neomexicana*), four wing saltbush (*Atriplex canescens*), sand sagebrush (*Artemesia filifolia*), snakeweed (*Gutierrezia sarothrae*), pale lycium (*Lycium pallidum*) and serviceberry (*Amelanchier utahensis*). There are few species of cacti; the most abundant are prickly pears (*Opuntia erinacea ursima*, *O. erinacea hystricina*, *O. fragilis*) and cholla (*Opuntia whipplei*).

The Painted Desert, which lies roughly between Tuba City and Leupp and is a minor subdivision of the Great Basin Desert, has only a few scattered species of these plants. Among these are saltbushes and grasses, primarily sacaton (Lowe 1964: 36-39; 1973:

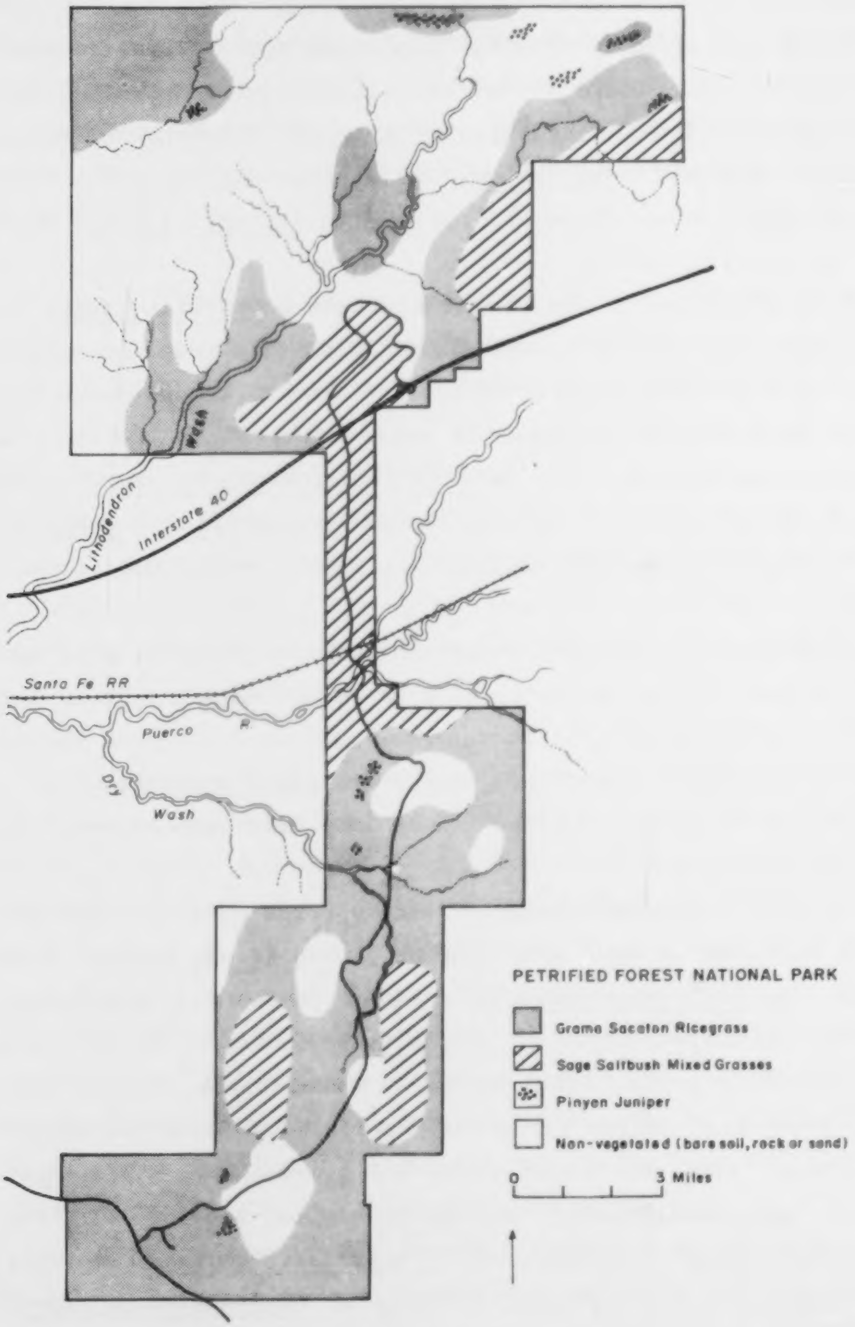
Lithodendron Wash
Interstate 40
Santa Fe RR
Puerco R.
Dry Wash
PETRIFIED FOREST NATIONAL PARK
Grama Sacaton Ricegrass
Sage Saltbush Mixed Grasses
Pinyon Juniper
Non-vegetated (bare soil, rock or sand)
0
3 Miles

Figure 2. Distribution of vegetation communities.

29-31).

Plains grassland in Arizona is a grammagrass-dominated short grass plain, often found in various mixtures with juniper-pinyon and sagebrush. Grasses are species of grama (*Boutelous*), fescue (*Festuca*), dropseed (*Sporabolus*), wheatgrass (*Agropyron*), muhly (*Muhlenbergia*), brome (*Bromus*), and galleta (*Hilaria jamesi*) (Lowe 1964: 43-44; 1973: 24-25).

Several species of Chenopodiceae, such as *Eurotia lanata* and *Kochia americana*, can be locally abundant in this zone, especially in the fine-textured alluvium of valley bottoms, around playa margins or in archeological sites of some depth. This also is true of various saltbushes, such as *Atriplex argenta*, *A. powellii* and *A. saccaria*. Occurring sporadically are *Artemesia* spp., *Ephedra* spp., *Lycium pallidum* and various species of yucca (Hevly 1964: 25-26).

Juniper-pinyon woodland occurs only sporadically at the higher elevations within the park, such as Chinde Mesa and Pilot Rock (DOI 1974: 9). Below 6500 ft junipers may occur in pure stands, but more frequently occur in juniper-grassland savannahs, as is the case in the park. Juniper has in many areas spread onto former range grassland.

The most common and characteristic species of pinyon and juniper in northeast Arizona are Colorado pinyon (*Pinus edulis*), Utah juniper (*Juniperus osteosperma*), one-seed juniper (*J. monosperma*) and Rocky Mountain juniper (*J. scopulorum*). Grasses include blue grama, sideoats grama, black grama, Arizona fescue, pinyon ricegrass, junegrass, Indian ricegrass, needlegrass, squirreltail and ring grass. Some species of herbs are globemallow, beardtongue, mariposa and paintbrush. Understory shrubs include cliffrose (*Cowania mexicana*), big sagebrush (*Artemesia tridentata*), serviceberry (*Amelanchier alnifolia*), rabbitbrush (*Chrysothemnus nauseosus*, *C. depressus*), fernbush (*Chamaebatiaria millifolium*), Navajo ephedra (*Ephedra viridis*), Fremont barberry (*Berberis fremonti*), Apache plume (*Fallugia paradoxa*), antelope brush (*Purshia triden-*

tata), black sage (Artemisia nova), banana yucca (Yucca baccata), Whipple cholla (Opuntia whipplei), beavertail (O. basilaris), fragile cholla (O. fragilis), prickly pear (O. polyacantha) and red hedgehog cactus (Echinocereus triglochidiatus melanacanthus). Species from adjacent life zones also occur frequently (Lowe 1964: 56-60).

Fauna. The most impressive group of fauna within the park is a small herd of pronghorn antelope. Infrequently sighted are bear, mountain lion and deer. Common small mammals are coyotes, bobcats and skunks. Rare and restricted to a few locations are porcupines, badgers and prairie dogs.

Most birds are seasonal occupants during migration. The golden eagle, raven, great horned owl, long eared owl and prairie falcon are permanent. The exotic English sparrow and starling now are park residents. Herptofauna include lizards, snakes, toads and salamanders (DOI 1974: 12).

Geology and Soils. The primary geologic formation within the park is the Petrified Forest member of the Chinle Formation, which is of Triassic age (ca. 200 million years old). The overlying Bidahochi Formation has been almost completely eroded from the park, except at Pilot Rock and Chinde Point. Overlying both in some places are recent alluvial and aeolian deposits.

The Petrified Forest member consists of upper and lower parts separated by the Sonsela sandstone bed, which lies unconformably on the lower part and intertongues with both the upper and lower parts. The lower part, sometimes called the blue mudstones, can be as thick as 300 ft. Individual units are thin, rarely thicker than 20 ft, and wedge out laterally within a distance of 100 ft. They are interbedded with sandstones of three distinct types of lithology. The most notable are the Newspaper sandstone bed, named for the many petroglyphs pecked into it, and the Rainbow Forest sandstone bed.

The Sonsela sandstone bed forms a physiographic break and causes a sharp color contrast between the overlying and underlying parts. It is conglomeratic in most areas and forms a continuous unit in the central and western parts of the park. It contains many fossils of Permian invertebrates.

The upper part of the Petrified Forest member is a banded aggregate of lenticular mudstone and siltstone units that appear reddish brown when viewed from a distance. Where not eroded it is more than 800 ft thick. Individual units are flat and lenticular. They exceed a quarter of a mile in length and can be more than 50 ft thick (Cooley 1957).

The topography within the park is the result of erosion of the Chinle Formation. The harder sandstone resists erosion and cliffs and mesas are the result. Underlying softer beds erode rapidly, producing sloping hillsides and conical mounds. The striking color contrasts are a result of erosional exposure of individual units within the formation. Erosion also accounts for the exposure of the large beds of petrified wood within the Chinle Formation (DOI 1974: 7-8).

Covering soils usually are sandy and interspersed with claystone, sandstones and conglomerates (DOI 1974: 8). They are of both alluvial and aeolian derivation. Aeolian soils form a sandy canopy of varying thickness and stability, particularly on mesa tops and along the sides of cliffs. This includes both active and stable dunes. Alluvial soils, which are derived from the Chinle Formation, tend to be clay-charged and alkaline, making them generally unsuited for agriculture (Wendorf 1953: 13).

Hydrology. The regional master stream is the Colorado River, which eventually receives all runoff from the area but a small portion that flows into the Rio Grande. The Little Colorado River, a perennial stream, is a major tributary of the Colorado, while the Puerco River, an ephemeral stream, is a tributary of the Little Colorado River (Harrell and Eckel 1939).

There are no perennial streams within the park. The Puerco River and major washes, of course, can flow full after a heavy rainfall. Lithodendern Wash, with known extensive ruins on its banks north of the park, drains the northern section. All washes eventually drain into the Puerco River, except those in the southernmost portion, which flow south into the Little Colorado River.

Within the park, there is at present only one working well, located along the Puerco River. Its yield is ample for park purposes, but its quality is not up to U.S. Public Health Service standards (DOI 1974: 9). Zuni Well west of the Visitor Center along Lithodendern Wash previously was in use. Springs at the base of a sand dune near Zuni Well and at the base of a cliff near Agate Bridge were used into the 1940s, but they no longer flow (George Johnson 1975: personal communication; Wendorf 1953). There are no flowing springs in the park at present.

The Effective Environment

The effective environment is a concept employed by investigators when approaching ecological research from a systemic point of view. The basic underlying principal, borrowed from general systems theory, is that a change in one part of a set of interacting variables will produce changes in other parts of the set. Thus far, formal use of the concept in anthropological studies has been limited primarily to defining interactions between a human population and its environment when studying the carrying capacity of a given subsistence system (Zubrow 1971). Ford (1972) uses the concept in an attempt to identify and explain social regulatory mechanisms that allow human populations to adapt to marginal environments. More informally, most archeologists now identify and describe known environmental variables (such as plants, animals and climate) that affected the human population under study, even when no further formal study is undertaken.

Ford (1972:2) succinctly outlines the definition of environment juxtaposed with that of effective environment:

> Environment consists of all the factors, biotic and abiotic, operating in a given area; nevertheless, some of these may not be immediately important for understanding a given system. Consequently, one must distinguish the effective environment (Allee et al 1949: 1), which is those variables of the universe external to the population that are directly or indirectly important to its survival... If one accepts the definitions employed here, it is immediately apparent upon comparison that many so-called ecological studies are merely environmental descriptions.

When dealing with the environmental variables of the region surrounding the park, several aspects become important. The first, as is true anywhere, is the interdependability of the variables. Prehistoric adaptation to an extremely arid environment was precarious and comparable to that of adapting to extreme cold or altitude. Frequently, the parts of the environment that affected human population were so delicately balanced that small changes could affect survival. This is particularly true of climate. For example, a change in effective moisture at any time could affect the regional hydrology, including amounts of available water for both plants and animals, drainage patterns, and soil aggradation and degredation. These, plus such factors as rainfall at an improper time to produce germination and growth of plants, could cause a change in types, amounts and ripening times of the plants of the region. This change could produce a difference in numbers and types of animals, perhaps causing different migration patterns or, in extreme cases, population depletion. For early hunters of big game this could force reactions or adaptations such as a change in subsistence base, movement into new areas to follow the same game, or human population depletion if the same area were used with no changes. Among Archaic hunters and gatherers, who supported themselves by harvesting both plants and animals in a complex seasonal round, similar consequences--such as changes in seasonal rounds, migration to new areas, development of food storage methods, or changes in the subsistence base--might follow. For agriculturalists, the change in effective moisture could produce a longer growing season with a greater possibility of drought. Crops would have to be more drought resistant to survive. Because of changes in the cut-fill sequence within the drainages, alternative planting areas would have to be sought. If crop failure was extensive enough, choices such as an increase in hunting and gathering or movement of all or part of the population would have to be made. If adverse conditions persist long enough, choices such as storage of a year's supply of food, as is done by the Hopi, or ceremonial redistribution of food (Ford 1972) have to be made.

The second important aspect is the diversity of microenvironments. While all of the lower Puerco River Valley may be described as similar, it actually consists of a mosaic of microenvironments. These consist of areas where topography, water, water retention, soils, winds, amount of rainfall and natural vegetation differ from those nearby. Modern Hopi make considerable use of these environmental mosaics, and it is probable that this was the case prehistorically. In fact, Bradfield (1971) discloses that the Hopi choose the exact areas to plant their fields by observing the plant cover (see Chapter 2). Some of these microenvironments have been delineated by the vegetation mapping discussed above. Further delineation of these areas and relating them to the climatic and archeological records will be a necessary part of future archeological work.

The third aspect is the availability of diverse macroenvironments. The contrasts between available water, natural plants, animals and general climatic conditions between the park and districts 50 to 75 miles away are immediately apparent. Ethnographic studies of both Hopi and Zuni pueblos show regular use of adjacent macroenvironmental areas. It is unknown whether the prehistoric populations of the park made use of the full range of macroenvironments available to them.

Critical Environmental Variables Within the Park

Brush (1975: 806) outlines three steps that scientists must take when formally delineating the effective environment: (1) identification of the key components of the cultural and environmental systems; (2) definition of the crucial variables that comprise the components of both, and (3) specification of the interrelationship between these components and variables. Archeologists dealing with prehistoric populations must address each of these problems, not the least of which is the actual delineation of the critical environmental and social variables through time.

All archeological studies within the park but one have not completed Step 1, so that delineation of critical environmental variables for any period is pure speculation. However, some critical variables from similar areas and periods of general development are known. Irwin-Williams' (1977) postulates concerning environmental response and sociocultural adaptation of Paleo-Indian groups are discussed below. If she is correct, critical environmental variables for this period could include such aspects of climate necessary for maintenance of adequate effective moisture of mesic grasslands as temperature, time of rainfall, hydrology and soil types. Other variables could include availability of stone for manufacturing tools and of plants suitable for the manufacture of spear shafts, netting and other necessary equipment.

Except for a few specific areas, general critical environmental variables for the Archaic and/or pre-Pueblo periods are poorly understood. Archaic groups generally are thought to have made intensive use of smaller territories and the different microenvironments within them. Their economic base was much broader and could include the use of just about every plant and animal within the territory. The settlement pattern was based on specific seasonal rounds of collecting or hunting as plants were ready for harvesting and animals were available. The people, with their generally smaller groups and a broader based economic pattern, could subsist on the plants of the less mesic environment that followed the Paleo-Indian period. On the basis of his study of perhaps equivalent modern hunters and gatherers, Gould (1970) suggests that short term loss of a great many food resources might not cause much hardship among these people. However, long term environmental stress, no matter what the cause, could pose serious problems, particularly if this stress followed a favorable period in which the human population had increased or if relatively firm territories of adjacent groups prevented territorial expansion. Variables that might be important here include types of natural plants (particularly those with high nutritive value), time of maturation of the various plants, types and numbers of animals, temperature, altitude, amount of effective moisture, available water for human consumption, and so forth. Important, too, would be the availability of stone resources for both chipped and ground tools.

During the late Archaic and Basketmaker periods, as agriculture became more and more important as a narrow subsistence base and the demographic pattern trended, in general, toward larger groups of people living permanently in one place, other environmental variables would become important for survival. Kirkpatrick and Ford (1977) discuss some interesting hedges against these new critical variables used in Basketmaker II and III near Cimarron, New Mexico. There the climate at the time was marginal for the practice of agriculture and the diet had to be supplemented by the collection of wild food plants. Variation in the size of corn kernels and beans indicated, among other things, careless farming habits. However, charred remains of supposedly collected food plants included several that grow today in such disturbed areas as agricultural fields. They conclude that selected wild plants were allowed to grow and were cultivated along with the corn and bean crops. In meager farming years these cultivated wild foods provided necessary food and in successful years they provided an addition to the diet. In fact, trends observed in the Hay Hollow Valley indicate the use of a smaller number of both plant and animal species during periods of greater effective moisture and an increase in numbers of species of plants and animals associated with archeological sites during periods of less effective moisture (Ward 1975). During favorable periods, prehistoric people could practice greater dietary selectivity (Euler et al 1978).

Ford (1972: 3-6) provides an excellent discussion of those aspects that affect modern pueblo populations and that could have affected prehistoric pueblo populations. The standard lists still apply, but season at which rainfall occurs, soil type and water retention value, nutritive value of the soil, and length of growing season become critical. Also necessary are clay and stone sources for making tools, vessels and houses, natural plant cover for toolmaking, medicinal and building purposes, and animals for dietary supplements and toolmaking.

While several archeologists have alluded to possible critical variables within the park at different times, Wendorf (1953) alone actually attempted to delineate some of them. These variables are types of soils and amounts of available water.

Soils and agricultural fields. Modern soils studies of the park do not exist. Wendorf (1953: 13) suggested that only aeolion soils, such as those found in dunes, were suitable for agriculture. Most of the alluvial soils are of bentonitic derivation and, therefore, too alkaline for farming. If he is correct, large areas, particularly those along the Puerco River and adjacent to major washes, may very well not have been useful as fields for prehistoric populations. Bradfield (1971), in researching Hopi agriculture, found that the Hopi choose new fields by studying the plant cover and that certain plants grow in appropriate densities on soils suitable for agriculture. Infrared photographs of the park, taken in order to produce a vegetation map, now exist. It may be possible to map areas suitable today for fields by using these vegetation photographs and maps, possibly in conjunction with pH sampling of the soil in chosen areas. However, this would not necessarily tell us whether these areas were prehistorically suitable or used for fields. If geological and climatic information also become available, however, it may be possible to delineate which areas absolutely could not have been used as fields. Archeologists might at least be able to make clearer assumptions about available acreage near sites such as the Puerco Ruin.

Wendorf also documented rock alignments similar to those used by the Hopi for dune farming (Hack 1942; Wendorf 1953). This type of agriculture depends on moisture accumulation within the sand. It is practiced in deep dunes, especially at the bottoms of mesa cliffs, and in shallow (2-3 ft) accumulations of sand on mesa tops. Both depend on relatively impervious soil or rock underneath the sand, which allows retention of water. This, of course, is the situation that frequently produces springs. There is no runoff from sand. Farming sand areas requires stripping the natural vegetation from the fields to prevent its using water, and then placing dead vegetation windbreaks held down by lines of rock to prevent the sand from blowing away. Barren areas with rock lines result when a field is abandoned.

Many of these alignments exist within the park, primarily in areas now desiccated. Known fields could easily be mapped with low level aerial photography. In addition to the absolute location of prehistoric fields, this would provide a basis for landform reconstruction.

Usable Water. Water, both for human consumption and for agriculture, is always a critical variable in an arid region, but water for agriculture is by far the most difficult to obtain. Although neither the park nor adjacent areas have been thoroughly surveyed, there is no question of the greater relative density of sites in the immediate park region than in surrounding areas. This could only occur with more available water than now exists in the park. Gregory (1916) and Harrell and Eckel (1939) provide excellent discussions of factors that affect regional availability of water and types of regional water resources. Several facts are of particular importance for delineating prehistoric water resources within the park.

The first is related to spring formations and their present distribution in the park region. Gregory (1916) lists five classes of springs. Geological formations suitable for all five classes are found within park boundaries, but there are now no flowing springs within the park. A seep spring near Agate Bridge flowed at least through the early 1950s (Wendorf 1953: 10; George Johnson 1975: personal communication). The yield was great enough that the water could be pumped to the mesa above for use. A sand dune spring in the vicinity of Zuni Well was in use until recently. It supplied a volume of water great enough for both human consumption and livestock watering (George Johnson 1975: personal communication). Adjacent to the park are several springs, such as those at Wallace Tank, which produce a volume of water great enough for use in livestock watering ponds. Wendorf (1953: 10) feels that park boundaries were drawn to exclude most nearby springs, leaving them available for wider use. Nearby soil formations would have made both known springs in the park suitable for agriculture. In fact, the stylized geological formations and soils combinations within the park--mesa tops covered with aeolion sands; sandstone caprocks or layers underbedded with impermeable bentonitic shales; large climbing dunes abutting the mesa bottoms, underlain by bentonitic shales--provide classic examples of places suitable for springs and for agriculture.

Changes in amounts or type of precipitation or removal of the aeolion cover on the mesa tops could have created situations that would result in the drying up of springs. It might be possible, by using geologic mapping, climatic interpretation charts derived from stratigraphic pollen samples, and dendrochronological precipitation charts, to delineate periods of high probability for the activity or inactivity of these springs.

Wendorf (1953: 10-18) presents an interesting nonclimatic hypothesis regarding the relationships between dune farming, present desiccation and present water supply:

> To judge from the evidence of such rock alignments, agricultural fields were usually situated either on mesa tops or near the bases of the mesa escarpments where climbing and falling dunes had accumulated and additional moisture was probably obtained as seepage from the mesa.
>
> The removal of the vegetation cover in those areas where fields were cultivated was probably indirectly responsible, through the eventual wind removal of the underlying sand, for many of the eroded areas which may be seen in the southern section of the monument. This statement is limited to the southern section only because the Painted Desert [Northern] Section is almost completely badlands and other factors are probably responsible for this condition. . . .
>
> The destruction of the vegetal cover through agricultural activity would free the sand and permit its rapid removal. As we have seen, the areas most suited for this type of agriculture were those which were underlain by Chinle shales. These extremely solvent shales, however, do not support vegetation and once exposed are rapidly eroded. The degree of erosion would be largely determined by the amount and the gradient of the area exposed but it would continue until the area is either (1) recovered by new sand dunes, (2) alluvial deposits capable of supporting vegetation have been deposited over it, or (3) reaches a stage of equilibrium. It seems likely, therefore, that many of the small barren flats, sometimes with rocks aligned over their surfaces, are the result of the practice of sand dune agriculture by the prehistoric inhabitants. It is believed that some of the eroded areas which lack rock alignments are localities where the erosion has proceeded so far that the alignments have been disturbed or the rock removed.
>
> A secondary effect of this removal of the sand cover may have been the destruction of springs. We have previously noted that the present water supply seems inadequate for a sizable population. Dune sand is a most important factor in the formation of springs for it provides an excellent intake and storage area for moisture. Removal of the sand allows the water to become lost either through rapid evaporation or surface runoff.

In short, it is possible that prehistoric farmers destroyed their own water supply (and ours) and brought about land desiccation without any sort of climatic change.

Cultural Change And The Environment

Because prehistoric groups in the Southwest interacted directly with their environment, reconstructions of past environments can be used to explain some aspects of cultural change. However, the relationships between the two are complex and not easily interpreted. While an environmental change of a certain magnitude may force a change in the subsistence system, the nature of the change is determined primarily by sociocultural factors (Euler *et al* n.d.). For example, Irwin-Williams (1977) argues that Paleo-Indian groups, particularly during the period 8500-6000 BC, had a narrow and restrictive economic base (hunting of large game only, particularly the bison) that included making extensive use of large territories and of only a few resources, rather than intensive use of smaller territories. There is a high correlation between Paleo-Indian settlement pattern data and amounts of effective moisture necessary to maintain the mesic grasslands upon which these hunted animals depended. When the effective moisture changed, these groups responded by following the herds as they moved to new areas and maintaining the existing sociocultural features of the group, rather than broadening their subsistence base and, in this case, changing their sociocultural system.

Schoenwetter and Dittert (1968) advance the hypothesis that the Anasazi chose to continue farming and to migrate to new areas when old areas became unproductive, even when hunting and gathering would have been more "adaptive," that is, easier and more productive on a year-to-year basis.

A recent study (Euler *et al* n.d.) based on archeological, geological, dendrochronological and palynological data firmly supports this postulate (although for different reasons than those advanced by the earlier authors). Further, the study demonstrates a covariance between Anasazi population dynamics and climatohydrologic changes of several orders of magnitude from at least as early as AD 880.

Within long term hydrologic cycles, a difference in population expansion and contraction occurred between areas that now have sparse surface water supplies, drier climates and longer growing seasons and those areas near the higher plateaus of the Rockies that now have more abundant surface water, wetter and cooler climates, and shorter growing seasons. Within the former, there was general population expansion onto the uplands during wetter epicycles, with population contraction (either decrease in growth or abandonment) and relocation toward drainage lines during the drought cycles. Within the latter, population expanded during the drought intervals and contracted during the wetter epicycles. Because these conditions consistently correlated with present climatic zonation, it is concluded that climatically determined population displacements toward the wetter, cooler northeast occurred during periods of drought, while population expansion to the uplands of the west and south, where dry farming could not otherwise be practiced, occurred during the wetter epicycles. The study also revealed cultural change, roughly corresponding to archeologically defined phases, that was related to relatively low level environmental changes. Lastly, it revealed various consistent local adaptations to environmental change in the area studied.

All three conclusions have relevance for studies at Petrified Forest, which is located within the climatic zone that now has a dry climate and a long growing season. Future studies should reveal fluctuating populations of agriculturalists similar to those that occurred in similar regions. However, as is discussed elsewhere, there are indications that effective moisture may not have been a major problem for the population until the mid-14th century. Discovery of the correlates of these major population trends, the effects of environmental changes of various orders of magnitude on the population, and local adaptations should receive major emphasis in future archeological studies.

General Environmental History. Most environmental history studies of the Desert West have been developed in response to those of Ernst Antevs (1962), who produced a series of such studies based upon geological data. He depicts Pleistocene and post-Pleistocene weather as falling into three stages of the Neothermal, which coincide with more northerly glacial advances and retreats. These stages are the Anathermal (8000-5500 BC), moist, cool climate becoming warmer and drier; Altithermal (5500-2000 BC), hot, dry climate, and Medithermal (2000 BC-present), moderately warm and somewhat arid. Although his dating provided the first usable chronologic base for prehistorians and a great deal of his work can be considered brilliant (Jennings 1968), a number of his conclusions recently have been challenged (Bryan 1950; Burma 1950; Flint 1957; Aschmann 1958; Martin 1963). A thorough discussion of Antevs' theories, as well as those of his critics, may be found in Jennings (1968: 54-60) and Bryan and Gruhn (1964). Criticism centers on the lack of absolute correlation between time and thermal units, the fact that alternating periods of wetness and dryness can occur within a thermal unit while remaining within an allowable range of variation, and the possible wetness or dryness of the Altithermal. As of now there are no early environmental absolutes.

There is general agreement that the modern environmental epoch began about 4000 years ago. As mentioned above, it is characterized by conditions similar to those of today, with alternating periods of wetness and dryness. Primary data for nearby parts of northeastern Arizona may be found in Bryan (1925, 1940), Hevly (1964), Haynes (1966), Gumerman and Sutton (1967), and Robinson and Dean (1969). Schoenwetter and Dittert (1968: 46) provide a composite pollen profile chart indicating hypothesized periods of increased wetness-dryness-coolness. More extensive charts of dendrochronological to moisture correlations (Robinson and Dean 1969) exist for the period AD 1000-1200, but these have not yet been fully interpreted. Charts for earlier periods soon will be published.

Little information exists for the period 2000 BC to 500 BC. What evidence there is seems to indicate cooler, moister conditions (Martin 1963).

The following synthesis, broken into smaller time increments, is taken primarily from Schoenwetter and Dittert (1968). Significant dendrochronological data (Robinson and Dean 1969: 7) are added for the years AD 1000 to 1200.

500 BC - AD 200. Little data exists for this period. There is no palynological information for the Colorado Plateau, but information from other areas of the Southwest indicates high (but variable) moisture values. Geological evidence indicates very little erosion, possibly with winter rainfall.

AD 200 - 700. The evidence seems to indicate long winters and increased moisture. A drought occurred between AD 200 and 300. From AD 300 to 700 it was consistently wetter and never drier than today. Geological evidence indicates general aggradation, with localized erosion.

AD 700 - 1100. A major environmental change from protracted winter rainfall to heavy summer rainfall occurred. Both vertical and lateral downcutting occurred on arable valley floors. The growing season lengthened, but so did the period of spring drought. Dendrochronological records show a general increase in moisture for the period AD 1110 to 1129, with extreme moisture decreases for the periods AD 1020 to 1049 and 1090 to 1109. Schoenwetter and Dittert (1968: 49) caution that this period, more than most, is unsuitable for consideration in general terms. Conditions from district to district were variable and periods of localized drought or moisture existed.

AD 1100 - 1300. The pattern of summer dominant rainfall continued. Widespread desiccation of valley floors continued to the point that very little arable land was left. Dendrochronological evidence indicates a period of general drought from AD 1140 to 1189. A wetter period occurred just prior to AD 1250, with widespread drought between the years AD 1274 and 1300. Again, local conditions were variable.

AD 1300 - 1600. The drought continued into the beginning of the 14th century. During this period an environmental change, involving a return to long winters and a consequently shorter growing season, began and continued until about 1850. Aggradation of previously eroded valley floors occurred.

In summary, little environmental history information exists for northeastern Arizona. That which does exist is difficult to interpret. No primary information exists for Petrified Forest National Park within periods known to have prehistoric human occupations. This information is critical for the understanding of prehistoric human populations.

Chapter 2

The Ethnography

Archeologists have used ethnographic analogy to help explain archeological evidence and, more recently, to try to explain cultural laws. Ethnographic data play two roles in archeological investigation: (1) they can be used to test hypotheses developed from the archeological evidence, which attempt to explain the relationship between material culture and behavior, and (2) they may be used as models for hypotheses of social (or other) relations to be checked for and tested in the archeological evidence (Binford 1968: 270). However, one cannot derive and test a hypothesis from the same ethnographic record. In each case other proofs must be used, and there are established methods for doing so (Binford 1967: 9-10).

Ethnographic analogies are not isomorphic correlations. Binford (1968), citing Webster's Unabridged Dictionary, defines analogy as

> a relation of likeness, between two things or of one thing to or with another, consisting in the resemblance not of the things themselves, but of two or more attributes, circumstances or effects. . .
>
> Analogy is frequently used to denote similarity or essential resemblance, but its specific meaning is a similarity of relations and in this consists the difference between the argument from example and that from analogy. In the former we argue from the mere

> similarity of two things, in the latter we argue from the similarity of their relations. . .

Ethnographic analogy will be important to park archeology, to cite one example, in interpreting the commonly observed (but seldom recorded) large lithic scatters. Ethnographic research among hunting-gathering groups reveals much about methods of stone procurement, tool manufacture and tool use, including the fact that a single tool can have a variety of uses (Lowie 1909, 1924; Spier 1928; Mooney 1912; Steward 1938; Gould 1968a, 1968b). Gould and others (1971) found that the mean degree of edge angles on stone tools reflects a difference in use (i.e., those from 35 degrees to 40 degrees, or sharp and thin, are used for knives) among a group of Australian aborigines. Semenov (1964) and Wilmsen (1968, 1970) have shown that microscopically observed wear patterns will vary with type of use. Whalen (1971) computerized many of these tool attributes and discovered specific areas within sites where groups of tools with related uses occurred, thus defining areas within which separate sets of activities were performed. The net result is that archeologists, by mapping the exact location of lithic flakes, tools and cores before collection, can determine within a fairly narrow range of variation what activities took place and the specific area where these activities occurred.

Perhaps settlement pattern, the geographic distribution and relationships of sites and the distributions of structures and other functional areas within a site, has been the most commonly used evidence in ethnographic analogy to archeology. Willey (1956: 1) states that settlement pattern is a "more direct reflection of social and economic activities than are most other aspects of material culture available to the archeologist." When used in combination with other types of evidence, settlement pattern studies can be very convincing. For example, both the Hopi and the Zuni observe matrilocal residence patterns, that is, in marriage the male moves to the residence of the female's family. When possible, related females live in groups of rooms adjacent to one another. Proceeding on the assumption that females made the pottery (as they now do) and that the inhabitants of the prehistoric Broken K Pueblo about 30 miles southwest of the park were, in part, probably ancestors of the Zuni, Longacre (1964) and Hill (1965) showed that at least two extended family groups lived in separate wings of the pueblo. They did this by analyzing similarities in painted design characteristics of pottery from individual rooms. Similarly, Schroeder (1961) has suggested, but not conclusively shown, that nuclear family groups occupied specific room blocks within the Puerco Ruin. The ruin has no exterior doors and outside entry apparently was by way of the roof. Interior rooms open into groups of usually three rooms used for storage, milling and sleeping, with no doorways between sets of rooms. This is a common arrangement in modern pueblos.

More complex and requiring more proofs are analogies concerned with relationships between sites. Just outside the park boundary lies an undisturbed site that contains an apparent plaza, several small interior kivas, an architectural feature similar to those previously described as dance courts (Roberts 1939, 1940) and a three or four-room pueblo. Four sites similar to this have been excavated in the region--the Plaza Site (NA 9400) in the Hopi Buttes area (Gumerman 1969), the Sundown Site (NA 9093) near Holbrook (Gumerman and Skinner 1968), a village site north of the park (Peter Pilles 1975: personal communication), and a part of the Whitewater group (Roberts 1939, 1940).

The sites are about 30 miles apart and contain more ceremonial rooms than the number of people living there could support. Gumerman (1969) suggests that the Plaza Site is a redistribution center, possibly for food. At present there is not enough settlement pattern or excavated information from the region to do more than consider the hypothesis. However, Ford (1972) has shown several mechanisms that operated within Eastern Pueblo groups to redistribute food, both on a regular basis and in times of crisis and between both individuals and groups. Food redistribution systems, frequently masked by ceremonial activities, are common in egalitarian societies living in marginal effective environments. Offering proofs for this hypothesis, both from sites within and outside the park, should be a common goal of future archeologists working in the region.

Pueblo IV occupations at the Puerco Ruin and nearby Stone Axe (Wallace Tank) Ruin have been shown to be directly related, and perhaps partly ancestral, to the Hopi and Zuni pueblos (Hough 1903; Schroeder 1961). The park abuts the Navajo reservation and an early (ca. 1750) Navajo site recently was found within the park. Hopi, Zuni and Navajo ethnographies offer the best possible source of hypotheses or analogous proofs for the archeological record.

The Concept of Western Pueblo

Since Parsons (1924) first described the differences in Eastern and Western Pueblos, anthropologists have hastened to point out more and more differences on the bases of language, archeology, social organization and physical type. Dozier (1972: 133-134) offers a view both of the general similarities of all pueblos and of the major differences between Eastern and Western Pueblos today. He feels that all pueblo society has five main concerns: weather, illness, warfare, control of flora and fauna, and village harmony. The Western Pueblos tend to resolve these concerns by the use of magical rites, with all activities subordinated to religion. Primary activities are related to basic subsistence, while warfare and hunting receive little attention. On the other hand, the Eastern Pueblos--and there are very basic divisions among them--approach these concerns on a more secular basis, although they do not lack religious concerns.

He describes the dominant features of the social organization of both:

> The western pueblos--Hopi, Hano, Zuni, Acoma, and Laguna--emphasize matrilineal exogamous clans, female ownership of house and garden plots, matrilocal residence,

> and the Katcina cult. Major religious emphasis is on weather control: rain production (by magical means) to make crops grow. The eastern Tanoan pueblos have a dual division of the society: bilateral extended families which appear to be minimal bilateral descent groups; male ownership of houses and land; matrilineal clans are absent; the Katcina cult while present is weak, and indeed the cult is absent among the Tiwa pueblos. Finally, there are a number of esoteric sodalities that crosscut the dual division organizations in membership. The major religious orientation revolves around government, which in the past was particularly concerned with regulating the tasks associated with irrigation and community work.... Curing or exorcism rites are likewise important, but these two preoccupations were highlighted far more among the neighboring Keresan pueblos. The Keresans are intermediate in their social organization and religious preoccupation (Dozier 1970: 133-134).

There is fairly widespread agreement about most aspects of the Western Pueblos, when they are considered alone. Only two of these pueblo groups, Hopi and Zuni, are important for this study, and agreement is even more common concerning them. Each group is discussed separately below, noting differences, similarities and, especially, those aspects thought to be of importance for the prehistory of the area.

Hopi Ethnography

Hopi villages are concentrated on or near a series of extensions from Black Mesa (see Fig. 1). These extensions now are called First, Second and Third Mesa. When the Spaniards arrived there were seven villages on four mesas. After the Pueblo Rebellion of 1680 some villages were abandoned or destroyed, while others moved from the valley to the mesa tops. About AD 1700 a group of Tewa-speaking people from the Rio Grande pueblos migrated to Black Mesa and were allowed to build the village of Hano adjacent to Sichomovi. Presently there are 11 villages: on First Mesa are Walpi, Sichomovi and Hano; on Second Mesa are Shongopavi, Shipaulovi and Mishongnovi, and on Third Mesa are Oraibi, Hotevilla and Bakavi. New Oraibi is located below Third Mesa and Moenkopi, a former summer camp, is about 40 miles away (Eggan 1950: 17-18).

Moenkopi, New Oraibi, Hotevilla and Bakavi are offshoots of the formerly large village of Oraibi, which has been plagued by dissension and strife (Titiev 1944).

Although they have a common language and culture, an important theme in Hopi life for comparative purposes is the lack of intervillage cooperation and integration. Each village is politically independent, conducts its own religious ceremonies and has priests who determine its own calendar. All of these activities are similar, but may vary slightly (Eggan 1950: 18, 116).

Eggan (1950: 18-19) describes village composition:

> Each village is divided into a series of matrilineal, totemically named clans which are linked or grouped in nameless but exogamous phratries. Each clan is composed of one or more matrilineal lineages, which, though nameless, are of great importance. The basic local organization is the extended family based on matrilocal residece and occupying a household of one or more rooms in common. In addition, there are various associations, both societies and kiva groups, which are involved in the performance of the calendric ceremonies.

Kinship, Clan and Lineage. The kinship system of the Hopi and the other Western Pueblos has been described by Eggan (1950: 19, 291-292) as classificatory (Crow), or organized on the basis of lineage principle. This was proposed on the basis of kinship terminology and is disputed by Schneider and Roberts (1956) and by Fox (1967). Dozier (1970: 137-138), however, states that no matter who is right, the terms are arranged according to lineage and do reflect behavior. He provides a lucid description of kinship behavior:

> Kinship behavior among the Western Pueblos may be comprehended most easily by a discussion of the extended matrilineal household where an individual receives his first and lasting cultural orientation. The household normally consists of a woman and her husband, married daughters and their husbands, unmarried sons, and children of the daughters. The women are the most important members of the unit; they own the house, are responsible for the preparation and distribution of food, make all the important decisions, and care for the ritual posses-

> sions of the family. The oldest woman of the household enjoys the most respect, and the members of the unit look to her for instructions and seek her advice in times of trouble. Next in importance is her eldest daughter, who assumes the duties and responsibilities of the household when her mother is away. Men born into the household and lineage leave the house when they marry, although they return frequently, exercise considerable authority in religious matters, and may discipline their sister's children when asked. The husbands contribute to the economic support of the household, teach their children the techniques of making a livelihood, and provide warmth and affection toward their children; but in disciplinary matters and economic decisions, they defer to their wives and their wives' brothers and uncles.

Lineages are maternally related family extensions and are the functional representations of clans. Until recently lineages lived in contiguous blocks of rooms (Dozier 1970: 140). Clans are composed of one or more lineages and are named. Members are considered to be genealogically related and behavior toward clan members is an extension of family and lineage behavior patterns. Each has a clan house, usually the home of the head woman. Clans are landholding groups and are exogamous (that is, marriage between clan members is not allowed). They are linked to associated clans in unnamed phratries. Phratries are the largest exogamous unit. Clans also are ranked, certain ones traditionally having control of various important ceremonies or activities (Eggan 1950: 61-64). The kinship system, with its pattern of matrilocal residence and extension of this pattern to lineage and clan, is important to archeology because some aspects may be reflected in household or settlement pattern, house construction, pottery design and other areas.

Religion and Ceremony. Religious and other ceremonies include the Katcina cult, the men's societies concerned with tribal initiation, the winter solstice ceremony and societies concerned with rain, war, clowning and curing. The ceremonial system is complex and is organized around a ceremonial calendar with certain ceremonies in the charge of a certain clan, society and kiva. Dates of particular rituals are determined by sun, moon or elapsed time from a preceding ritual. There is a common pattern for each major village, although minor variations are found. The only tribe-wide organization is that of the Katcina cult.

Rites most frequently are conducted in kivas, but some take place in the main houses of the clan in charge. Hopi kivas are subsurface rectangular chambers, oriented north-south and entered through the roof by means of a ladder. They are owned by the clan that built them. However, when a kiva falls into disuse, it becomes the property of the clan that repairs it. While the kiva is owned by the clan, kiva membership (male only) crosscuts clan affiliation and may be related to tribal initiation rites. Much of the time kivas are used as a "clubhouse" or place of "escape" for male members of the village. Clanhouses are indistinguishable from other rooms in the pueblo, but are considered sacred.

Ceremonies are owned or controlled by a particular clan, which takes care of the ritual paraphernalia, usually kept in the clanhouse. In practice, the lineage occupying the clanhouse usually is in charge. Ceremonies are performed by societies or fraternities whose membership crosscuts the clan system. This is accomplished by having "ceremonial fathers" and "ceremonial sons," who must belong to different clans, as well as curing and trespass memberships.

Rainmaking ceremonies are emphasized by the Hopi, but many other ceremonies are conducted for a wide variety of purposes. These formerly included those for war, hunting and salt-gathering expeditions (Titiev 1944: 102-103; Eggan 1950: 89-106; Dozier 1970: 140-142).

Political Organization. There is no such thing as true political organization among the Hopi. What controls exist are intertwined with religion. Properly speaking, the villages are not even organized together into a tribe. There is seldom any intervillage cooperation, each village being responsible for its own welfare.

Within each village various village "chiefs" have primarily patriarchal, rather than legislative, functions. Cooperation for cleaning springs, gathering wood for kivas, etc. is entirely voluntary. The primary mechanism for achieving the necessary ends of the group as a whole is that of group disapproval. However, formerly both the war chief and various Katcinas could mete out some forms of mild physical punishment (Titiev 1944: 59-68; Eggan 1950: 106-109). Titiev (1944: 68) has aptly characterized the situation:

> Within each village the lack of a strong central authority permits the growth of factions and leads to schisms; and between pueblo and pueblo there is an attitude of jealousy, suspicion and subdued hostility. Never has any town been entirely free from strife, and never has a leader arisen to mould the autonomous villages into a co-ordinated unit worthy of being called a tribe. Whatever other talents they may possess, the Hopi do not have the gift of statecraft.

Subsistence. The primary source of Hopi subsistence has traditionally been agriculture, with an emphasis on the Southwestern triumverate of corn, beans and squash. However, no actual testing for the proportion of gathered products to agricultural products, nor of the proportion of seedbearing plants to other cultivated plants, occurred until the 1930s or 1940s (Whiting 1954). In order to make the best agricultural use of a hostile environment, the Hopi had to develop a complex interacting system involving social practices, as well as land use and settlement pattern practices.

Because of the relative scarcity of usable farmland, land distribution is of first importance in describing Hopi subsistence. Until the 1880s land was distributed by a clan bloc system. Permission to use clan lands was granted by the "clan mother" (Page 1954: 9). Plots outside clan lands could be farmed by individuals with the permission of nearest neighbors. In addition, separate plots were distributed to persons of honor. These plots were worked and harvested with ceremony and celebration by the entire village (Titiev 1944: 184-186). Land use patterns have changed considerably since that time, with a marked shrinkage of clan blocs and an increase in individual use, particularly near Third Mesa. Definite boundary lines exist between areas owned by particular mesas, although boundary disputes do occur. These boundaries are based on traditional claims. Other boundary changes have occurred in response to Navajo settlement and the introduction of grazing animals. Boundary claims relating to animals were established on a first come first served basis, with outlier corrals being established when lands closer to the village were used up (Titiev 1944: 9-15). Maitland Bradfield (1971: 35-37) found that land distribution changes in the Oraibi Valley, which occurred as a result of climatic factors coupled with the introduction of draught animals and cars and trucks, threatened the traditional fabric of the pueblo way of life.

Most farming practices appear to be the result of centuries of adaptation. Hack (1942) has produced the classic treatise on this subject, but published works by Titiev (1944), Bradfield (1971), Whiting (1950) and Ford (1972) offer not only supplementary material but also different approaches to the subject.

Hack (1942: 26) classified Hopi fields in four primary categories, with subdivisions of each:

I. Fields watered by surface run-off (floodwater farming)
   1. Akchin fields (at arroyo mouth)
   2. On floodplains of large streams
   3. On flood terraces of large arroyos
   4. In bottoms of small arroyos
   5. Trinchera fields (on artificial terraces in drainage ways)
   6. Watered by hillside wash (probably not found in Hopi country)

II. Fields watered by rainfall
   1. Sand dune agriculture--sandy soil
   2. In alluvial and other soils (in higher parts of Navajo country)

III. Fields watered by underground seepage (seepage fields)

    1. In dune sand
    2. In colluvial soils
    3. In dune hollows

IV. Irrigated fields (usually in colluvial and alluvial soils)
    1. Irrigated by diversion of permanent streams (not found on Hopi Reservation but common at Moenkopi)
    2. Irrigated from springs

In his more recent study Bradfield (1971: 36) found that

> the primary factor determining the choice of a field site is, and has always been, the availability of water in the form of surface runoff, either directly from an adjoining talus slope or indirectly via a tributary water course: and secondary to this, the capacity of the subsoil to retain the moisture that reaches it. Both factors are reflected in plant cover, and Hopi know best where to make their fields by looking at the vegetation.

Planting dates are regulated by the ceremonial calendar. The Hopi do not rotate crops, preferring to plant particular crops in areas where best results have been achieved before (Whiting 1950: 13-14). However, alternating of hillocks or holes where individual seeds are placed, as well as renutrifying the soil by letting it lie fallow, apparently compensates for this (Hack 1942; Titiev 1944; Bradfield 1971). Individual farmers cultivate several plots of the same crop in widely varied areas, so that at least one crop has a chance of receiving water (Whiting 1950: 4).

Essential to Hopi agriculture is the specialized plant adapted to the severe climate (Wendorf 1953: 15). In 1936 Whiting (1954b) found that while Hopi farmers did not understand genetics, some genetically sound agricultural practices were used. At that time more than 50 percent of the seeds for crops planted on the reservation were obtained by inheritance or through marriage. However, 80 percent of the beans and 90 percent of the corn were obtained in this manner. These seeds came from varieties developed over time to do best in the area. Seeds accepted from outside the family were primarily those for fruits and vegetables, such as peaches, watermelons and apples, introduced since the arrival of the Spaniards. Marriage was found to be the primary mechanism for seed distribution and varieties were inherited within the household.

In addition to cultivating domesticated crops, the Hopi cultivate wild plants by several methods. Some plants, such as sunflowers, mint, wild tobacco and dock, are planted in suitable fields or gardens along with regular crops. Plants that seed themselves naturally, such as Rocky Mountain bee weed, wild potato (Solanum jamesii) and devil's claw (Martynia), are allowed to mature in cornfields. Still other useful plants are semi-cultivated. Cottonwood and willows are transplanted to nearby washes. Hopis also were observed transplanting cattails from Tuba City near their villages (Whiting 1950, 1954b).

Virtually all authors mention the fact that informants speak of the former importance of gathered crops at times when cultivated crops failed. It is interesting to note that Watson (1954) found a linguistic difference in the classification of staples and certain other foods called uh: ngala. At least formerly, these were foods that were rare or hard to obtain. It was considered bad manners and a misuse of food for a person to eat heartily of uh: ngala. This category included all meat, gathered plants, garden vegetables and items such as sugar and salt. Whiting found an amazing number of gathered plants, both from nearby and distant areas, to be used regularly. He compiled a list of 298 such wild plants, 100 of them in everyday use (Table 1). Of the roughly 200 plants found in the local environment only a very few were deemed unusable. These plants are used for food, decoration, building, firewood, basketry, medicine, ceremony and implements; in fact, their use was pertinent to every aspect of Hopi life.

Titiev (1944: 188-193) provides an excellent summary of game hunted, techniques employed, ceremonies involved and distribution methods. Other primary references include Parsons (1936), Beaglehole (1936), Stephen (1929), Hough (1898), Nequaptewa (1933) and Curtis (1922). Since the early part of this century the organized hunting drives of the Hopi have been restricted largely to rabbit

Table 1: Plants used by the Hopi
(after Whiting 1950).

COMMON NAME	SCIENTIFIC NAME
Almond	Prunus amygdalus
Apache plume	Fallugia paradoxa
Apple	Malus sylvestris
Apricot	Prunus armeniaca
Jerusalem artichoke	Helianthus tuberosus
Aspen	Populus aurea
Aster	Aster spp. Aster leucelene Townsendia arizonica
Bean	Phaseolus spp. Phaseolus vulgaris
Aztec bean	Phaseolus multiflorus
Cow bean	Phaseolus vulgaris
Dark bean	Phaseolus vulgaris
Blue dye bean	Phaseolus vulgaris
Grease bean	Phaseolus vulgaris
Lima bean	Phaseolus lunatus
Black lima bean	Phaseolus lunatus
Red lima bean	Phaseolus lunatus
White lima bean	Phaseolus lunatus
Pink bean	Phaseolus vulgaris
Pinto bean	Phaseolus vulgaris
Mexican pinto bean	Phaseolus vulgaris
Puppy bean	Phaseolus vulgaris
Red bean	Phaseolus vulgaris
String bean	Phaseolus vulgaris
Light string bean	Phaseolus vulgaris
Purple string bean	Phaseolus vulgaris
Red string bean	Phaseolus vulgaris
Yellow bean	Phaseolus vulgaris
Beardtongue	Pentstemon caudatus
Beebalm	Monarda menthaefolia
Bee weed	Cleome serrulata
Birch	Betula accidentalis
Bladderpod	Lesquerella intermedia
Blanket flower	Gaillardia pinnatifida
Blazing star	Mentzelia pumila procera
Fringed brome	Bromus cilatus
Rabbit brush	Chrysothamnus spp.
Scarlet bugler	Pentstemon barbatus
Cactus	(Cactaceae)
Cholla cactus	Opuntia whipplei
Caltrop	Trixbulus terrestris
Canaigre	Rumex humenosepalus
Casava	Cucumis melo

COMMON NAME	SCIENTIFIC NAME
Cattail	Typha angustifolia
Cockle bur	Xanthium saccharatum
Colorado blue stem	Agropyron smithii
Coriander	Coriandrum sativum
Corn	Zea mays Zea mays amylacea
Blue corn	Zea mays amylacea
Hard blue corn	Zea mays amylacea
Soft blue corn	Zea mays amylacea
Spotted blue corn	Zea mays amylacea
Havasupi chin corn	Zea mays amylacea
Purple dented corn	Zea mays amylacea
Flying eagle corn	Zea mays amylacea
Gray-blue corn	Zea mays amylacea
Kachina corn	Zea mays amylacea
Owl corn	Zea mays amylacea
Pink corn	Zea mays amylacea
Purple corn	Zea mays amylacea
Red corn	Zea mays amylacea
Spotted corn	Zea mays amylacea
Sweet corn	Zea mays saccharata
Red sweet corn	Zea mays saccharata
Violet corn	Zea mays amylacea
White corn	Zea mays amylacea
Yellow corn	Zea mays amylacea
Cotton	Gossypium hopi
Cottonwood	Populus spp.
Coxcomb	Amaranthus cruentus
Blister cress	Cheirinia sp.
Currant	Ribes inebrians
Deer's ears	Frasera sp.
Devil's claw	Martynia louisiana
Dropseed	Sporobolus contractus Sporobolus flexuosus
Giant dropseed	Sporobolus giganteus
Euphorbia	Chamaesyce spp.
Fennel	Foeniculum officinale
Fern	Asplenium trichomanes
Douglas fir	Pseudotsuga mucronata
White fir	Abies concolor
Yellow flax	Linum australe
Four o'clock	Quamoclidion multiflorum
Bracket fungi	(Fungi)
Gilia	Gilia aggregata Gilia longiflora Gilia multiflora
Goldenrod	Solidago petradoria
Gourd	Lagenaria vulgaris
Wild gourd	Cucurbita foetidissima

COMMON NAME	SCIENTIFIC NAME
Blue grama	Bouteloua gracilis
Grape	Vitis sp.
Holly grape	Odostemon fremontii
Oregon grape	Odostemon repens
Grass	(Poaceae)
Bear grass	Nolina sp.
False buffalo grass	Munroa squarrosa
Galleta grass	Hilaria jamesii
Purple hair grass	Muhlenbergia pungens
Manna grass	Panicularia nervata
Needle-and-thread grass	Stipa comata
Herb or grass	(Poaceae)
Sand grass	Calamovilfa gigantea
Squirreltail grass	Sitanion hystrix
Three-awn grass	Aristida spp.
Greaswood	Sarcobatus vermiculatus
Groundsel	Senecio longilobus Senecio multicapitatus
Horsetail	Equisetum laevigatum
Ironwood	Forestiera neomexicana
Jimson weed	Datura meteloides
Juniper	Juniperus utahensis
Lambsquarters	Chenopodium spp. Chenopodium album
Larkspur	Delphinium scaposum
Mariposa lily	Calochortus aureus
Black lima	Phaseolus lunatus
Yellow lima	Phaseolus lunatus
Loco weed	Oxytropis lambertii sericea
Dwarf lupine	Lupinus kingii
Mountain mahogany	Cercocarpus eximius
Globe mallow	Sphaeralcea spp.
Melon	Cucumis melo
Mescal	Agave parryi
Milkweed	Asclepias galioides Asclepias involucrata Ptiloria pauciflora
Indian millet	Oryzopsis hymenoides
Mistletoe	Phorandendron sp. Phorandendron juniperinum
Mormon tea	Ephedra torreyana Ephedra viridis
Mullein	Verbascum thapsus
Tansy mustard	Sophia pinnata
Oak	Quercus spp.
Onion	Allium spp. Allium cepa
Painted cup	Castilleja linariaefolia
Peach	Prunus persica

COMMON NAME	SCIENTIFIC NAME
Pear	Pyrus communis
Chili peppers	Capsicum annuum
Pimento peppers	Capsicum annuum
Phacelia	Phacelia integrifolia
Pig weed	Amaranthus blitoides
Pine	Pinus ponderosa
Pinyon	Pinus edulis
Plantain	Plantago purshii
Potato	Solanum tuberosum
Wild potato	Solanum jamesii
Prickly pear	Opuntia sp.
	Opuntia polyacantha
Pumpkin, squash	Cucurbita moschata
Purslane	Portulaca oleracea
Reed	Phragmites communis
Giant reed	Arundo donax
Rose	Rosa arizonica
Cliff rose	Cowania stansburiana
Rush, etc.	(Poaceae)
	(Cyperaceae, Juncaceae)
Alkali sacaton	Sporobolus airoides
Safflower	Carthamus tinctorius
Sage	Salvia carnosa
Bursage	Franseria acanthicarpa
Sagebrush	Artemisia spp.
	Artemisia tridentata
Mountain sagebrush	Artemisia frigida
Sand sagebrush	Artemisia filifolia
Saltbush	Atriplex confertifolia and other species
Fourwing saltbush	Atriplex canescens
Sandwort	Arenaria eastwoodiae
Seep weed	Dondia fruticosa
Shadblow	Amelanchier pallida
Corn smut	Usitilago zeae
Sorghum	Sorghum vulgare
Snake weed	Gutierrezia lucida
Spectacle pod	Dithyrea wislizeni
Spiderwort	Tradescantia sp.
Turban squash	Cucurbita maxima
Sumac	Rhus trilobata
Sunflower	Helianthus spp.
Hopi sunflower	Hilianthus sp.
Tepary	Phaseolus acutifolius latifolius
Black tepary	Phaseolus acutifolius latifolius
White tepary	Phaseolus acutifolius latifolius
Thistle	Cirsium pulchellum
Russian thistle	Salsola pestifer
Tobacco	Nicotiana attenuata
	Nicotiana trigonophylla

COMMON NAME	SCIENTIFIC NAME
Tomatilla	Lycium pallidum
Tomato	Lycopersicum esculentum vulgare
Wild tomato	Solanum triflorum
Trompillo	Solanum elaeagnifolium
Sand verbena	Abronia elliptica
	Tripterocalyx wootoni
Watermelon	Citrullus vulgaris
Kuwanyesva's watermelon	Citrullus vulgaris
Wheat	Triticum sativum
Willow	Salix sp.
Willow-herb	Epilobium adenocaulon
Winter-fat	Eurotia lanata
	Tetradymia canescens inermis
Wormwood	Artemisia dracunculoides
Yucca	Yucca angustissima
Broad leaf yucca	Yucca baccata
Narrow leaf yucca	Yucca angustissima

hunts, although similarly organized coyote hunts have been conducted. In both cases associated religious and social ceremonies, as well as ritual distribution, occurred. There also were occasional forays for antelope or mountain goat. These were informal, consisting of fewer hunters and no required ritual. Stephen (Parsons 1936: 277-279) describes an antelope drive conducted in the late 1800s when antelope were more plentiful. The animals were driven into a V-shaped enclosure.

Hough (1898: 141) describes the Hopi liking for meat; while the primary diet was vegetal, it was supplemented whenever possible with meat. Titiev (1944: 193) considers the increase in utilization of sheep a compensatory measure for the lack of hunting and a method for procuring meat without it.

Zuni Ethnography

The Zuni occupy a section of northwest New Mexico along the permanently flowing Zuni River, which is environmentally more advantageous than those areas occupied by other Western Pueblo groups. Their language is unrelated to and different from all other Southwestern Indian languages (Swadesh 1956; Harrington 1945). From the arrival of the Spaniards in the 16th century they have been subjected to more continuous and in-depth acculturative influences than have the other groups, but through it all they have managed to retain their own cultural values and ways. In fact, they have achieved a degree of social, cultural and economic integration that is rarely matched among modern Indian groups (Eggan 1950).

Archeological evidence indicates that both historic and modern Zuni settlements were influenced (and probably partially founded) by the area's original inhabitants, the Chaco branch of the San Juan Anasazi and the Mogollon (Woodbury 1956). While they now occupy only the large pueblo at Zuni and smaller settlements at Ojo Caliente, Blackrock, Pescado and Nutria, they formerly occupied a belt extending primarily from Gallup, New Mexico, to St.

Johns, Arizona. When Coronado arrived in 1540 six pueblos, K'iakima, Matsaki, Halona, Kwakina, Hawikuh and K'ianawa or Kachipawan, were occupied. After withdrawing to Corn Mountain (Towayalane) several times under various adverse conditions, the Zuni returned to the valley for the last time and began living in their present location in 1705 (Dutton 1963: 5-15).

Social Organization. The Zuni are divided into matrilineal, exogamous, totemically named clans, each of which has one or more unnamed lineages. The economic unit is the household, composed of an extended family, which is a matrilineal lineage or a segment thereof. All persons, male and female, born within the household are lifelong lineage and clan members. While males are recruited through marriage, their ritual household affiliations remain with their native households.

The household resides in a series of adjoining rooms owned by the females of the group. The group owns fields and the crops they produce. However, with the development of herding, male economic ties have become stronger through sheep, which are individually owned and inherited in the male line. While females may call upon any male relatives for help in emergencies, tilling of fields and housebuilding usually are accomplished by household males. Authority within the household is invested in the mother's mother.

Clans maintain fetishes kept in a household of the clan. Unlike the Hopi, these are sometimes kept in a "clan named house," sometimes not. There is evidence both that the clan system is diminishing in importance and that it has changed since Cushing first described it in the 1880s. The number of clans dropped from 16 in the 1880s to 13 when described by Bunzell in 1927. These losses are related to deaths of individual members. Cushing presented evidence that clans previously probably had been integrated into phratries with dual division. There now are no phratries; clans have many members and their sizes are roughly equivalent to Hopi phratries (Eggan 1950: 176-201).

Religious or Ceremonial Organization. Religion occupies a central position in Zuni life. The general religious base is ancestor worship. It is a religion in which everyone participates, individuals and priests in different manners (Eggan 1950: 202-203). Bunzell (1932: 509-511) describes the cults developed therefrom: "The functions, activities and personnel of these groups overlap and interweave in a bewildering intricacy that baffles analysis." She divides cults into (1) the cult of the suns, (2) the cult of the Nwanami, (3) the cult of the Katcinas, (4) the cult of the priests of the Katcinas, (5) the cult of the War Gods and (6) the cult of the Beast Gods.

The Zuni ceremonial calendar correlates and coordinates these cults. The cycle of ceremonies begins and ends with the winter solstice. While theoretically the calendar repeats itself semiannually, in practice there is more winter than summer ceremonialism (Eggan 1950: 209).

Political Organization. Eggan (1950: 210) succinctly and thoroughly describes Zuni political organization:

> 'Political' authority is in the hands of a council of priests composed of three members of the chief priesthood and the heads of three other priesthoods. The head of this hierarchy is the 'house chief,' who is head of the chief priesthood (that of the north), assisted by the pekwin or Sun Priest, who acts as a talking chief for the priesthood. The two Bow Priests act as an executive arm; the heads of the Katcina society serve as advisers. The principal matters which come before the council relate to the appointment of secular officers, impersonations of the gods, the time of tribal initiations, changes in the ceremonial calendar, and questions of tribal policy. They have the welfare of the pueblo in their hands and are too sacred to be concerned with secular quarrels and problems. Internal crimes such as witchcraft are the concern of the Bow Priests; formerly they tortured suspects to induce confession.
>
> The council appoints a set of secular officials: a governor, lieutenant-governor, and some eight assistants to carry out relations with outsiders and to deal with civil suits, quarrels over property, cooperative work on

> roads and irrigation ditches, etc. These officials hold office at the pleasure of the priests and may be removed at any time. The governor and lieutenant-governor should not be from the same clan, and their assistants are generally chosen from different clans. Whether or not this civil government is 'in substance a native institution,' as Kroeber believes, its activities were expanded to deal with the new problems brought about by Spanish contacts.

Subsistence. Agriculture is the traditional primary source of Zuni subsistence. However, Bohrer stated in 1960 that the economy of Zuni was becoming more wage-money related, and this may now be the case.

Zuni agricultural practices are different from those of the Hopi. Aside from tradition, this possibly is related to environmental factors: (1) the Zuni River, while small, is a perennial stream and offers a continuous source of water, and (2) the reservations lie in different ecological zones. Although annual rainfall is similar, the Zuni reservation is higher and falls primarily within the pinyon-juniper vegetation zone, while the Hopi Reservation falls primarily within the desert steppe-desert grasslands zone.

Both dry farming and irrigation techniques are used. Irrigation is now practiced primarily near springs at Ojo Caliente, Nutria and Pescado. There formerly were irrigated gardens on both banks of the river, especially on the north bank (Mills 1979). Zuni irrigation apparently is an indigenous technique and it is possible that it was practiced more extensively in earlier days. Three types of fields are used: (1) a level low-walled (mud) plot, such as is used for wheat (the entire field is flooded at once); (2) an unleveled plot with low walls, such as is used for melons (water is guided from plant to plant with the use of low deflecting walls and hoes) and (3) "waffle" gardens, a series of walled squares about 1 or 2 ft on a side that are individually irrigated with a bucket; chilis are the primary crop grown here, but coriander, onions, ground cherry (Physalis longifolia Nutt.), amaranth and an unidentified herb may be grown (Bohrer 1960: 181-183).

Several dry farming methods are used, depending on the crop planted (Cushing 1920; Bohrer 1960). Fields for maize are prepared by creating an open-ended diversion dam of mud, stones and brush in a flat space in an arroyo that drains from hills or mountains. This area is then allowed to silt up for a year before planting. Previously used fields are rejuvenated by repairing the dams or planting brush where corn grows weakly. Bohrer mentions the fact that the USDA recommends these practices as sound for water distribution and erosion control in the area. If at all possible, these crops are irrigated by building earth walls and channeling, just before tasseling occurs. A technique used for pumpkins and squash is to plant in the floodplain or arroyos where a new deposit of silt has been laid. This planting is naturally irrigated by rainfall with very little plant loss.

Field crops known to have been grown from prehistoric times include maize, beans, gourds, squash, pumpkin, cotton and amaranth. Although more recent species have been added to each of the traditional crops, those judged by both Hopi and Zuni informants to have been the "old" staple crops still frequently are grown. Post-Spanish crops include wheat, muskmelon, watermelon, sunflower, coriander, onion, chili, peaches, apples, alfafa and miscellaneous garden vegetables (Bohrer 1960: 183-201).

Matilda Coxe Stevenson (1908) compiled from her personal knowledge and that of her informants a comprehensive and straightforward account of gathered plants and their uses. The two primary uses of gathered plants at the time were for food and medicine, but gathered materials also were used for weaving, dyeing, basketry, mats, brushes, rope, cord, pottery decoration, "in the toilet" and ceremonial goods.

Edible plants are gathered from both near and far. Many plants either are allowed to grow or are cultivated in garden plots. Bohrer (1960) specifically mentions the ground cherry and an amaranth that are extensively cultivated. The list of edible plants is long. Of particular interest is Ericoma cuspidata, a member of the grass family that Stevenson's Zuni informants declared had previously been a food staple. She quotes from a USDA report (Palmer 1871):

> Ericoma cuspidata. This is a singular species of grass which is found growing wild in moist sandy spots in Nevada, Arizona, and New Mexico, and produces a small, black, nutritious seed, which is ground into flour and made into bread. It is held in high estimation by the Zuni Indians of New Mexico, who, when their farm crops fail, become wandering hunters after the seeds of this grass, which is abundant in their country. Parties are sometimes seen ten miles from their villages, on foot, carrying enormous loads for winter provisions.

The list of medicinal plants is equally long. The Zuni, like other Pueblo groups, use specific plants and plant concoctions for specific illnesses. This includes an effective cure for rattlesnake bite. Many long known medicines, such as ergot and datura, were "discovered" much later by "civilized man." As Stevenson (1908: 63) states:

> . . .it is evident that for a long period the Zuni Indians have extensively employed medicines for healing the sick. . . .In fact, the life of the Zuni is a prolonged ceremony from birth to death, of which plant life forms a conspicuous part.

Navajo Ethnography

In terms of population maintenance and achieving their own ends or purposes, the Navajo are now, and were almost from the time of their arrival, probably the most successful of the Indian groups in the Southwest. Downs (1972) suggests three reasons for their success: (1) From the first, they made use of or were adapted to environmental niches that were different from those of surrounding groups. In the opinion of many, their primary subsistence techniques of earlier hunting and gathering and later pastoralism are eminently more suited for survival in the Southwest than the technique of agriculture without benefit of modern technology. (2) They apparently had, and retain, a lifestyle that allowed for the acceptance of new technological equipment and new subsistence techniques without much change in their way of life. (3) They assumed a trading role, which allowed not only for their success but also for that of the groups with which they interacted, yielding a working symbiotic relationship.

History. The Navajo are relative newcomers to the Southwest. Their language is related to the Northern Athapaskan languages and they are linguistically classified as Southern Athapaskan or Apachean. Although both their migration route and their arrival time have always been disputed, it is now thought that they migrated from Canada via the eastern plains of the Rockies and arrived in the Southwest in the 16th century. Wilcox (1974) presents a good general discussion of this and related problems.

The Navajo do not appear to have been agriculturalists. They are thought originally to have been hunters rather than gatherers. They moved into a land occupied by puebloan and other farmers and were able to occupy the many diverse environmental niches that were not being fully exploited by farmers. With the settling in to diverse environments came cultural divergence. Most groups settled outside the curve of pueblo influence, but one group, the Navajo Apaches or Apaches of the big fields, established a continued and intensive contact with the puebloans.

Little is known about their earliest lifestyle. Nomadism was necessary. The basic unit probably was a small band of related people. They probably introduced the composite bow, as well as hard-soled moccasins. Bison, elk, deer, pronghorn antelope, rabbits, wild turkey, porcupine and other game were hunted. Pinyon nuts, grass seed, berries, roots and other plants were collected. They lived in conical houses constructed of light poles covered with brush or grass, as had the ancient hunting-gathering ancestors of the puebloans. They made simple pottery, used baskets, used the dog as a beast of burden and wore clothing similar to

Great Basin nomads. Their religious life probably was centered around shamans and curing, as is that of many hunter-gatherers worldwide.

The character of the relationships between the Navajo and the puebloans at this early stage is unknown. Originally, archeologists proposed warfare between the two groups as a major reason for pueblo abandonment and movement to the tops of mesas, but it is now generally conceded that the Athapaskans arrived later. By the time the Spanish missionary Benavides (1945) speaks of them in 1630 they have begun to live in hogans, semisubterranean houses made of logs with a domed roof. Hunting and gathering still were practiced. They had adopted farming just to the extent that they could establish large residential units. One outgrowth of this was the practice of polygamy. The political structure is unknown, but the Spaniards dealt with "captains," men who apparently were leaders. Benavides mentions that established trade existed with the people of Santa Clara Pueblo. Large groups of Navajo came with their wives and children to trade dressed animal skins and mineral pigments to the puebloans.

There later were both peaceful and hostile relations between the Navajo and the puebloans. The Pueblo Rebellion of 1680 promoted closer relationships through warfare alliances and living together as a result of these alliances.

By the early 1700s much of Navajo culture as it is known today had been formed. Archeologically and historically they were different and distinct from other Apachean groups. During this and the following period, the Navajo began the practice of herding, learned from the Spanish, as the primary form of subsistence. The necessary patterns of transhumance apparently were integrated into the nomadic hunting pattern. Depending on areal environment, more or less farming was practiced. Settlement pattern consisted of relatively permanent groups of hogans arranged in a winter rancheria. In summer, brush shelters were constructed. Movement occurred all year. Occupants of these groups of hogans consisted of matrilineal, matrilocal extended families. Homestead location depended on access to water and wood, along with defense possibilities. The Navajo learned the art of weaving from puebloans, but women, rather than men, were the artisans. They wove wool rather than cotton, and early on their blankets became important trade items. Other trade items included baskets and raw wool.

During this time Navajos practiced raiding, apparently as a part of their ceremonial life and as an adjunct to subsistence. Settlements of other Indians, Spaniards and Anglos were raided for livestock, slaves and moveable goods. They never destroyed the subsistence base of those they attacked. In defense from other attacking groups or people conducting reprisals, they frequently moved settlements to isolated canyons, mesa tops or other hard-to-get-at places.

Following the Long March in 1863 and their internment at Ft. Sumner, which nearly destroyed the Navajo, they returned to a newly designated reservation. Except for raiding, they returned to their own way of life--rebuilding, acquiring material goods from contacts and producing goods for trade with Anglos. They have never accepted Anglo religion, lifestyle or political organization (Downs 1972: 1-16; Vogt 1961).

The Navajo Today. Navajo social structure is extremely flexible and difficult to define. Downs (1972: 22-28) has extracted four general themes: (1) the female principle (the importance of the female is stressed in all spheres, including matrilocality, kin terms, mythology, some political roles, relations between the sexes, religions and magic), (2) the inviolability of the individual, (3) the primacy of age, and (4) reciprocity (among both family and non-family groups a network exists for recompensing any gift or favor with food, money, etc).

The approximately 50 Navajo clans, unlike those of the puebloans, are not locational. Their primary function is in marriage restrictions. Clans are exogamous both paternally and maternally.

Other functions are provisions of clan mates for traveling and assistance financially and ceremonially under certain conditions.

A person's entire life is spent in close contact with relatives. Most aspects of behavior, subsistence techniques and daily living directly correlate with kinship relations following the above mentioned themes. Kin terms are complex and anthropologists do not agree in their analyses (Downs 1972: 28-43).

Typical social units also are difficult to define. Social units consist of families, homestead and outfits. There are two family units: nuclear and extended. A homestead group usually consists of several related females and their nuclear families. It is the minimum unit for survival. Nuclear families within the group live in individual housing, which may be arranged in a very compact grouping or scattered over perhaps half a mile. Homestead groups share responsibilities for a herd of sheep, agricultural fields and all daily activities. This sharing occurs at many levels: caring for herds, tending and using produce from the fields, cutting of firewood and hauling of water, cooking responsibilities, rituals and ceremonies (Downs 1972: 28-39). Kluckhohn (1947: 62-63) originally defined an outfit as a

> unit that is larger than an extended family and bound together by kinship ties and cooperation. . . widely dispersed in a territorial sense, a community in its own right with a leader, usually the eldest male but with a matrilineal orientation.

This definition stands today, but new sorts of cooperative units, some governmentally designated, have now taken over old style outfits (Downs 1972: 30-31).

Until very recently, the Navajo tribe as an entity did not exist. While people recognized a difference between their group (as a whole) and others, allegiance, decisions and actions were based upon relationships within the homestead group. No further political structure existed.

Navajo religion "is a matter of constantly observing the laws of the universe rather than the commands of God" (Downs 1972: 96).

The religious practices, like those of the Hopi, reflect the social structure. Hopi religion has a set calendrical order and an individual participating in a ceremony shows his position in relation to the total community. Navajo religious practices do not follow set schedules and a participating individual exhibits his relationship to members of his own family or to the host family, depending on the ceremony. Rituals fit several categories both public and private. Many daily activities, such as the creation of handmade household utensils, require elaborate ritual. Sweathouses are used by both men and women of the homestead under different circumstances. Sings are held for a variety of reasons. Squaw dances, held to purify Navajos exposed to foreigners, eventually involve most of the neighboring countryside.

Homestead groups have traditional use areas, land on which a family and its ancestors have regularly grazed animals. Size and numbers of these territories vary among homestead groups, with primary determinants being environmental ones related to the needs of the herd and of humans. Considerations include water, type of rangeland, amount of available firewood, altitude and weather. Depending on these environmental factors, a homestead group may practice true transhumance, moving between widely separated summer and winter grazing areas. In other cases, the herd may be moved around one large contiguous area and movement of base camps may not be necessary.

Summer basecamps, the primary homestead, usually are located on the alluvial fans that spread out around the bases of hills and mesas. Homes may be closely spaced or widely scattered with accompanying ramadas and sheep pens. Winter basecamps have houses that are smaller and more clustered. Temporary camps used for various aspects of both herding and farming usually are brush lean-tos against natural rocks or bushes. Sweathouses are built near homestead groups. Various other brush structures are constructed for some rituals, such as particular sings or squaw dances (Downs 1972: 95-113).

Agricultural success also depends upon environmental factors. In some areas crops are unsuccessful in one out of three years. Crops include corn, beans, pumpkins, melons, squash and peaches, all adopted either from puebloans or Spaniards.

Fields are the basic element for survival of the nuclear unit. They are not handled communally, as is herding, but are tended by individual nuclear units. They are located within the traditional use area but may be at a considerable distance from basecamps. In the past fields were planted in an unusual spiral pattern in the area that Downs studied, but with the advent of the plow they have become conventional. Care of the crops consists of only the most basic necessities--plowing, planting, hoeing and harvesting (Downs 1972).

Chapter 3

The Archeology

The archeology of Petrified Forest National Park is complex and poorly understood. Little comprehensive information exists for the park or for the immediately surrounding territory, here called the Lower Puerco River region to distinguish it from nearby previously named and archeologically defined regions, such as the Upper Little Colorado region, the Middle Little Colorado region and the Upper Puerco Valley. Most archeological studies were done 30 to 40 or more years ago and do not provide the type of data and analysis that will allow accurate placement of the park's archeology within general trends or that will allow substantive and comprehensive comparison with adjacent areas and general Southwestern archeology. The available information precludes making management decisions affecting any but the most recently surveyed tracts of land. Work has been done for a variety of reasons, including pure research, museum collecting, immediate salvage and cultural resource management. Analyses and conclusions are uneven, leaving large gaps in the most basic types of data.

Even so, several general statements may be made concerning the known and assumed aspects of park archeology. First and most important is the effect of the park's location on its archeology. Petrified Forest is located between two major topographic zones, plateau to the north and mountains to the south, each of which provides a completely different set of natural resources and was inhabited by two different major Southwestern cultural groups. There is easy north-south access to both zones. In fact, the earliest archeologists in the region followed and explored some of these routes in an effort to validate Hopi migration myths. The Puerco River bisects the park and joins the Little Colorado River at Holbrook to the west. Much further west the Little Colorado joins the Colorado River, the primary regional stream. All three rivers pass through regions that, through time, supported a diversity of cultural groups. To the east the Puerco and San Jose rivers provide access to the Rio Grande through mountain passes to the north. At present, both the Santa Fe Railroad and Interstate 40 follow this easy, natural route (Gumerman and Skinner 1968). Location, then, effectively sets the stage for a number of cross-cultural occurrences.

At no time was the area a cultural center from which a major tradition or subtradition emanated, but from the earliest to the latest known settlements within the park there was repeated intercultural mingling. At least three major groups, Anasazi, Mogollon and Sinagua (Fig. 3), as well as subgroups within the Anasazi and perhaps within the latter group, contributed significantly to the archeology of the park. This blending is not uncommon in archeological boundary areas between two or more groups of people, but it has rarely been studied and is poorly understood. Other than simple propinquity, the mechanisms for and meaning of this mingling are unknown. This phenomenon enormously complicates the archeology, particularly interpretation, and makes it necessary to consider cultural and environmental occurrences from a very large area when dealing with the park.

Although no population studies or estimates have been done, all present evidence indicates a significant population within the park and immediately surrounding territory from at least pre-AD 500 until about AD 1450. This does not seem to be the case for the general region, but previous studies do not contain the infor-

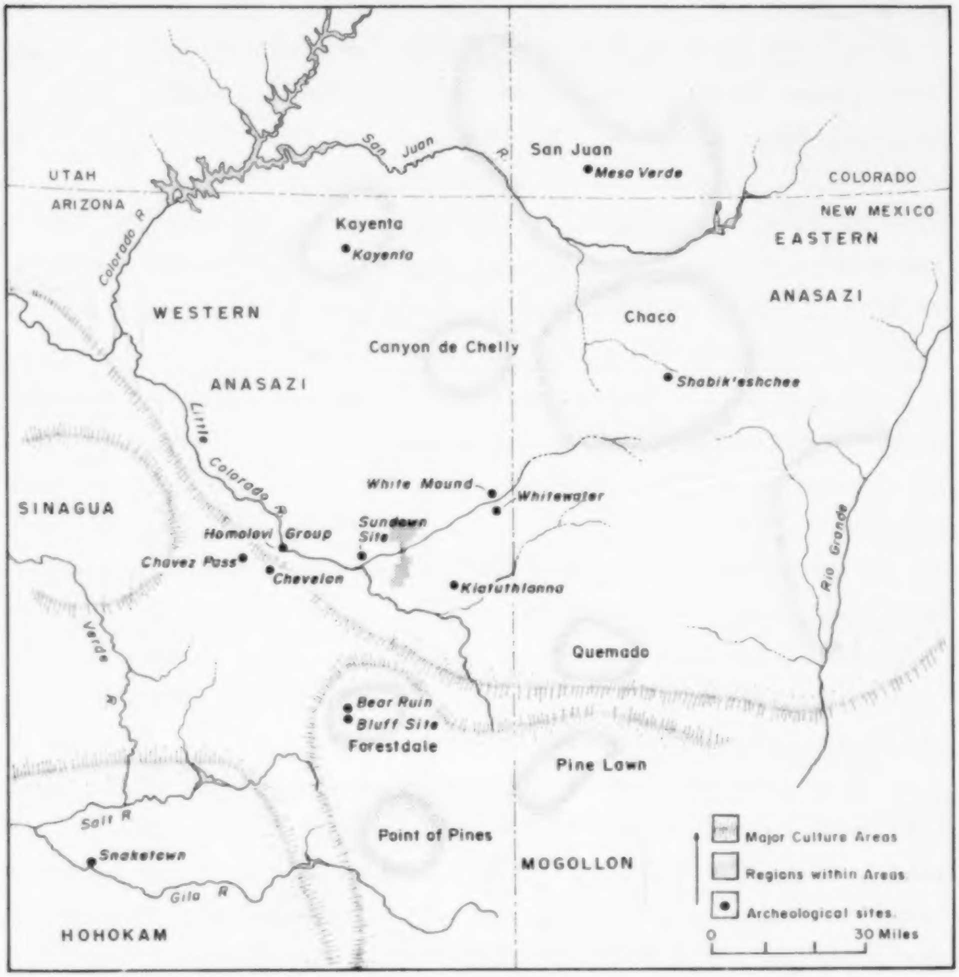
UTAH
ARIZONA
Colorado R
San Juan R
San Juan
Mesa Verde
COLORADO
NEW MEXICO
EASTERN
ANASAZI
Kayenta
Kayenta
WESTERN
ANASAZI
Canyon de Chelly
Chaco
Shabik'eshchee
Little Colorado R
White Mound
Whitewater
Sundown Site
Homolovi Group
Chavez Pass
Chevelon
SINAGUA
Kiatuthlanna
Rio Grande
Verde R
Quemado
Bear Ruin
Bluff Site
Forestdale
Pine Lawn
Salt R
Snaketown
Gila R
Point of Pines
MOGOLLON
HOHOKAM
Major Culture Areas
Regions within Areas
Archeological sites
0
30 Miles

Figure 3. The park in relation to major culture areas.

mation necessary to document the situation. Two major factors mentioned by Wendorf (1953) may have been operating to produce this larger than usual population: greater effective moisture and/or greater impact on the frontier area from other influential populations. If this is, in fact, the case, a study of the interplay between environmental influences within the park and sociocultural influences from outside the park, particularly as they related to ethnic boundary areas, could make a significant contribution to Southwestern archeological studies.

In addition to general statements, there are general problems with classification extrapolation that must be considered. They are common to all Southwestern archeology, particularly in those areas where little recent work has been done. Because most work in the park was done so long ago, the various classificatory systems used directly affect the present interpretation of the culture historical record of Petrified Forest. Fig. 4 compares several chronologies developed by archeologists for specific areas within the larger region.

In an attempt to bring order to a growing assortment of data, the Pecos Classification System was formulated, primarily at the instigation of A.V. Kidder (1927). This was the first such attempt in American archeology and was sorely needed. The system was based on field data and had cultural-chronological emphasis. Because it was so badly needed, the system was widely and sometimes rigidly accepted (primarily as a chronological tool), as the tremendous variability between traits, settlement pattern or other aspects of areas were noted. Although many attempts have been made to modify the system or to clarify its problems (see Roberts 1935, Brew 1946, Jennings 1966), the system still is used for the Anasazi primarily as a chronological tool for comparison and synthesis. Much later, Wheat (1950) developed a similar, but numbered rather than named, classification system for the Mogollon in an attempt to synthesize regional phase sequences. These large areal frameworks still are useful as general indices, but they

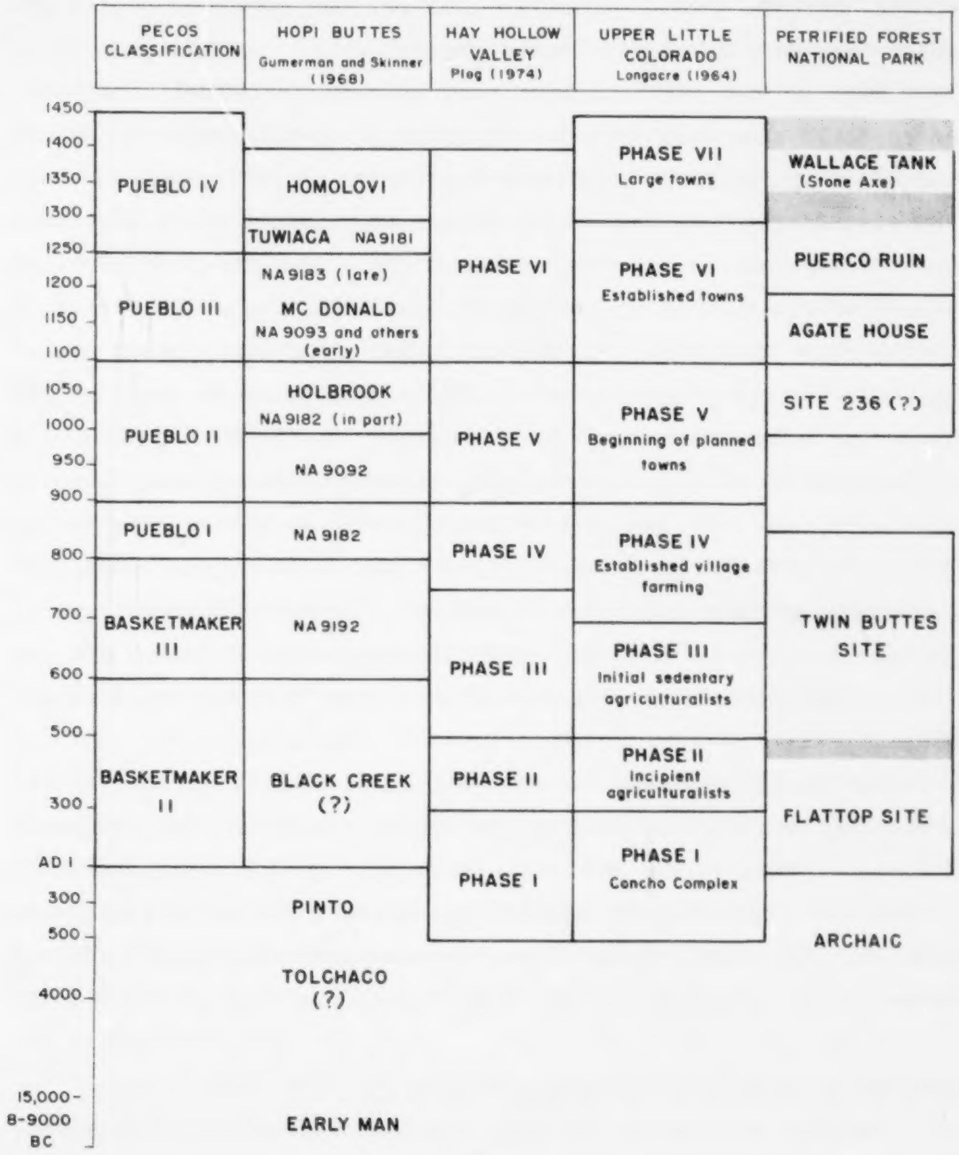

Figure 4. Comparative chronologies.

should not be indiscriminately applied to regional sequences, which vary considerably from the general.

Much of the archeological work done in Petrified Forest occurred at a time when both descriptions of cultural traits and attached chronological endpoints were being strictly adhered to. However, no absolute dates have ever been obtained within the park and no regional sequence developed. Archeologists have compiled groups of traits from the original classification, a smattering of judgmentally determined settlement pattern information and cross-dating on pottery with absolute dates that vary as much as 500 years in other regions. They inserted the information into a classificatory system that implies absolute dates. Extrapolations then were made from one partially or totally excavated site to include all sites with similar pottery combinations. Although this is variable, many conclusions will be revised with future work, particularly those relating to settlement pattern, dating and relationships to general or specific sequences or processes in other areas.

Similarly, the park has always been considered Anasazi in the archeological literature on no apparent basis other than arbitrary decision. Because the Pecos Classification has always been used, it will be used in this review. But whether the inhabitants were Anasazi, Mogollon, Sinagua or various combinations at various times is, at present, an unanswered question.

History of Regional Archeological Studies

Pioneer regional archeology was done by Fewkes (1898, 1904), leading an expedition for the Bureau of American Ethnology, and by Hough (1903), leading the Museum-Gates Expedition. The primary mission of both expeditions was collection of artifacts, but both also attempted to trace archeologically the Hopi myths of clan migration from the south, compiled ethnological information on the Hopi, established prehistoric faunal and human skeletal collections, located and mapped most of the larger ruins in east central

Arizona, and excavated portions (usually burial grounds) of a great many sites. Their observations were astute and, in many cases, the hypotheses they advanced now are being tested and justified. The expeditions together covered an area ranging from the Hopi Mesas to Show Low and from Flagstaff to the Zuni pueblos. In areas closely related to the park, Fewkes mapped and partially excavated the Homolovi group and the Chevlon Ruin, both near Winslow. Within the park, Hough mapped and partially excavated the Puerco Ruin (called Adamana by Hough) and the Twin Buttes Site (called Metate by Hough); Wallace Tank (originally called Stone Axe Ruin), Woodruff Butte, the Milky Hollow group, the Canyon Butte group, the McDonald's Canyon group and Scorse Ranch just outside the park also were investigated.

H.P. Mera (1934; Cosgrove 1951), employed by the Laboratory of Anthropology, Santa Fe, supervised a project in the 1930s that was designed to interpret and stabilize sites within the park. The project included reconnaissance survey, excavation and stabilization. Mera personally conducted the survey and recorded 109 sites within the park and a few adjacent areas. Mera's observations and hypotheses, although now refined, still are definitive for the park. C.B. Cosgrove directed the partial excavation and stabilization of the Puerco Ruin and the Flattop Site. The Puerco Ruin was partially excavated twice in the 1960s, by Schroeder (1961) and by Jennings (1967), for the purposes of interpretation and stabilization.

In the 1940s Erik Reed (1940, 1947; Jepson 1941), a National Park Service archeologist, supervised for a number of years an intermittent survey of much of the southern sector of the park and excavation of a small rockshelter that was suffering water damage (Gale 1941). More than 300 sites were recorded and collected. Wendorf, working under the auspices of the Museum of Northern Arizona and using Reed's sherd collection, along with his developed pottery horizons, analyzed and redeveloped a series of pottery horizons for early sites. As a result of hypotheses formulated during this exercise, he excavated portions of the Flattop and Twin Buttes sites in an effort to more clearly define aspects of the earliest known components of the park (Wendorf 1948, 1949, 1953).

Several other sites within the park have been recorded or excavated as a result of federal resource management programs. Harrill (1970, 1971, 1972), then with the Museum of Northern Arizona, excavated a small camp site (NA 10,808) near Jim Camp Wash when a federal highway was rerouted. Several previously unrecorded sites with standing walls were recorded by the National Park Service's List of Classified Structures team (Sudderth _et al_ 1976). Several new sites also were recorded in advance of excavation within the garbage dump area north of Interstate 40 near the main park headquarters (Stewart 1976). Thornton (1977) intensively surveyed 40 acres near the stables and two lithic sites were recorded. Hammack (1978) intensively surveyed a 15.5 mile long corridor along Blue Mesa and Mainline roads. She recorded 27 sites. An expanded discussion of each survey and excavation is provided in Appendix I.

One mile south of the park Harrill (1973), working for the Arizona State Museum, excavated the Dobell Site, a small pithouse village. Comparisons of settlement pattern, subsistence, architecture, ceramics and other artifacts are made with nearby areas. Several major differences, particularly in settlement pattern, are noted. Except for a salvage project that followed a linear route, very few other archeological investigations have been done in territories adjacent to the park. (Unfortunately, the Western Archeological Center did not have access to the salvage project report.) Slightly further afield, to the east and northeast, several major excavations of Anasazi site complexes were done. These included the Whitewater (now called Allentown) and Kiatuthlana excavtions by F.H.H. Roberts (1931, 1939, 1940) and White Mound Village by Gladwin (1945). Generalizations concerning settlement pattern, architecture, ceramic and other artifact complexes, subsistence strategies and trade goods frequently stand today because there simply has been no further work of a comparable scale. Over the last 20 years quite a number of sites have been recorded, tested or excavated because of the construction of Interstate 40 and accompanying facilities (Wasley 1960; Gumerman 1966; Gumerman and Olson 1968; Ferg 1978).

In the Forestdale Valley to the south, Haury (1940; Haury and Sayles 1947) excavated two very early sites, the Bear Ruin and the Bluff Site. Anasazi contacts were plain in this Mogollon region and some phases showed a definite Anasazi-Mogollon blend. Edward Danson (1957) conducted a reconnaissance survey for the Peabody Museum, which included east central Arizona south from St. Johns. Initially under the direction of the late Paul S. Martin, the Field Museum of National History for the last 18 years has conducted its continuing Southwest Archeological Expedition in the Upper Little Colorado area, concentrating primarily in the Pine Lawn, Tularosa and Hay Hollow valleys of Arizona and New Mexico. This has been an extremely thorough project and has pioneered new methods of analysis, new types of results and new theoretical concepts (see, among others, Martin and Rinaldo 1960; Martin, Rinaldo and Longacre 1961; Martin *et al* 1962, 1964; Hill 1972; Plog 1974; Longacre 1976).

The central Little Colorado Valley due west of the park has been largely ignored. On the basis of pottery types contained in the reports of Fewkes and Hough, as well as his own unreported surveys, Colton (1939) defined the Winslow branch of the Anasazi, essentially equating the branch with two pottery types (Gumerman 1968: 187). Pond (1966) investigated one kiva at Homolovi II, one of the four large ruins within the Homolovi group, and discovered definitely close relationships with the Hopi pueblo area. A more recent survey of the McDonald Canyon area (Wilson 1967) recorded an early population apparently larger than that immediately to the west. Breternitz (1957) excavated a site near Winslow in connection with a highway salvage project. Near Holbrook, Gumerman and

Skinner (1968) excavated a series of sites that exhibit important relationships to the archeology of the park. Most recently, Gumerman (1969; Gumerman and Sutton 1967; Gumerman and Skinner 1968), working in conjunction with the U.S. Geological Survey, Branch of Astrogeology, in an attempt to use archeology as an aid in determining paleoclimatic fluctuations and changes in surface geology, surveyed 25 square miles within the desiccated Hopi Buttes area north of Winslow. Recorded sites numbered 211, six of which were excavated or tested. In general, the region was found to have been prehistorically as desiccated as it is now. Gumerman was able to establish a regional chronology and to formulate hypotheses concerning settlement pattern, social organization, functional uses of some types of pottery, and occurrences in nearby areas.

Virtually all information about the area immediately north of the park has come from two pipeline surveys (Bliss and Ezell 1956; Olson 1964) and Breternitz's (1957) highway salvage project.

In summary, archeological work within the Lower Puerco River region has progressed sporadically and has been done for a variety of reasons, with consequent differences in depth and standards of results. Neither the park nor any adjacent area has been studied comprehensively. The last large locational survey in the park occurred 35 years ago. The last major excavation in the park occurred 30 years ago. Basic archeological knowledge of the entire Southwest has changed considerably since then. Advances in theory and technology of information recovery, such as the Carbon 14 method for absolute dating and the use of palynology in studies of climate, have been considerable. In short, archeological information and analysis from Petrified Forest is deficient and sadly out of date.

Regional Culture History

The following discussion both outlines the culture history of the region that contains Petrified Forest National Park and details the culture history of the park itself. Two maps of the park supplement the discussion: Fig. 5 shows the extent of major archeological survey; Fig. 6, 7 and 8 show site density and label major sites mentioned in the text. The chapter concludes with a summary of park archeology.

Early Man (circa 15,000 BC to 8000 BC). Often called big game hunters, Early Man in western North America is characterized by a distinctive toolkit featuring lanceolate and fluted projectile points and an association with very large extinct animals. Although there are many that do not fit specific categories and remain anomalous, sites of these early hunters are usually separated into three chronologically overlapping groups distinguished by tool typology and associated fauna. In particular, there is an overlap of time and geographic area in Llano and Folsom sites.

Much simplified, Llano, the earliest, is characterized by Clovis points and other tools and is associated especially with the mammoth. The most representative associated animal species in the Folsom category is the extinct bison (Bison antiguus); the most distinguishable tool type is the Folsom point. Tools from the Plano group, youngest of the three, are slightly more generalized. Still lanceolate in form, they are not fluted and may be finished in a pattern of long, thin pressure flakes. Either completely modern fauna or an overlap of modern and extinct animals are associated. The geographic range of Plano sites is much larger than that of Llano and Folsom.

Only two types of sites, kill sites and campsites, are known. Most campsites are small; while there are no known permanent settlements, a few, such as the Lindenmeier Site, contain evidence of at least a seasonal return. Campsites offer more complete toolkits and features, such as hearths, than do kill sites, so that a broader range of activities can be inferred. Even so, evidence of little beyond the usual cooking, toolmaking and inferential hideworking and other common activities necessary to subsist on big game has been found at such sites. No evidence of structures has

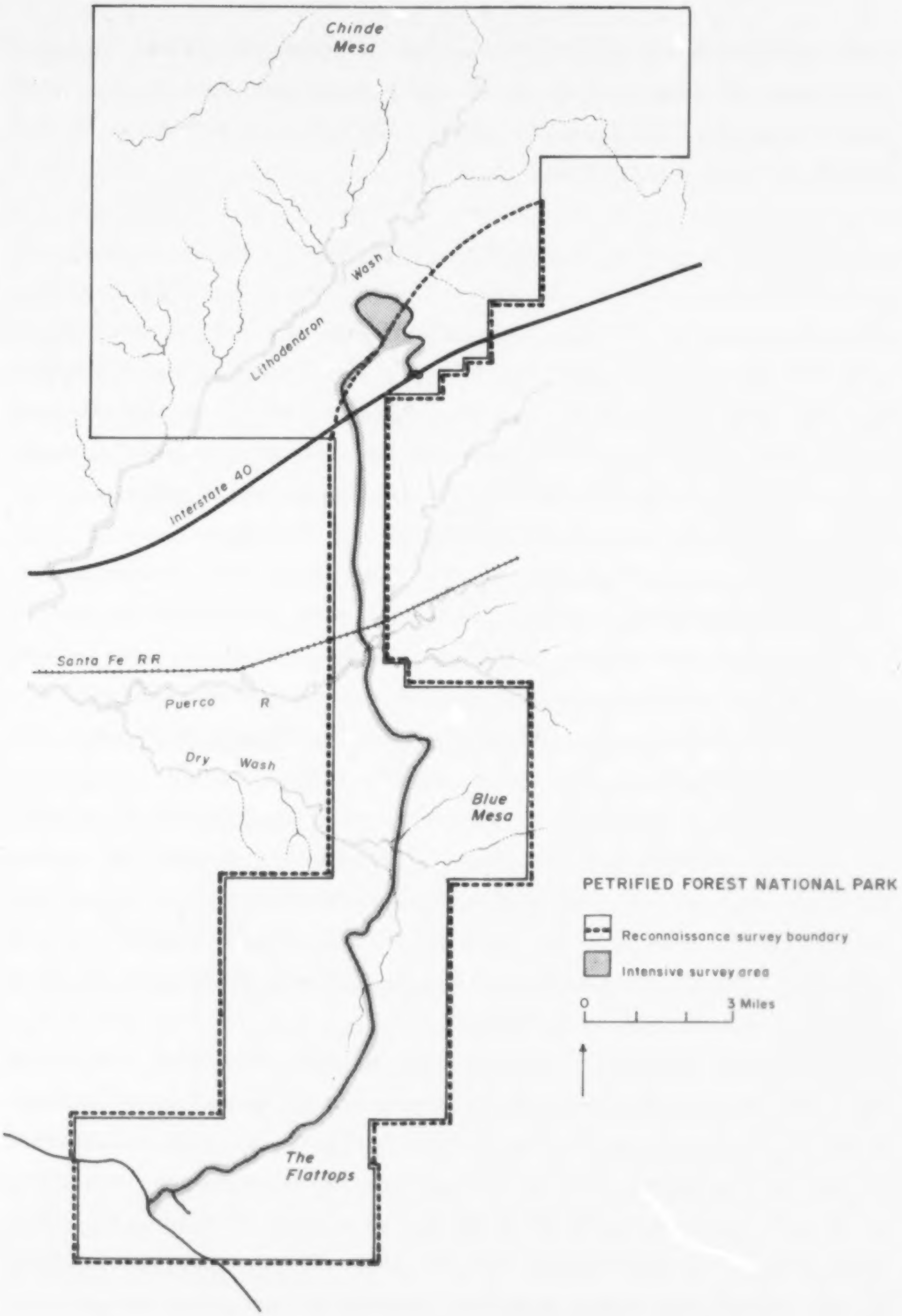
Chinde Mesa
Lithodendron Wash
Interstate 40
Santa Fe RR
Puerco R
Dry Wash
Blue Mesa
The Flattops
PETRIFIED FOREST NATIONAL PARK
Reconnaissance survey boundary
Intensive survey area
0
3 Miles

Figure 5. Park areas covered by archeological survey.

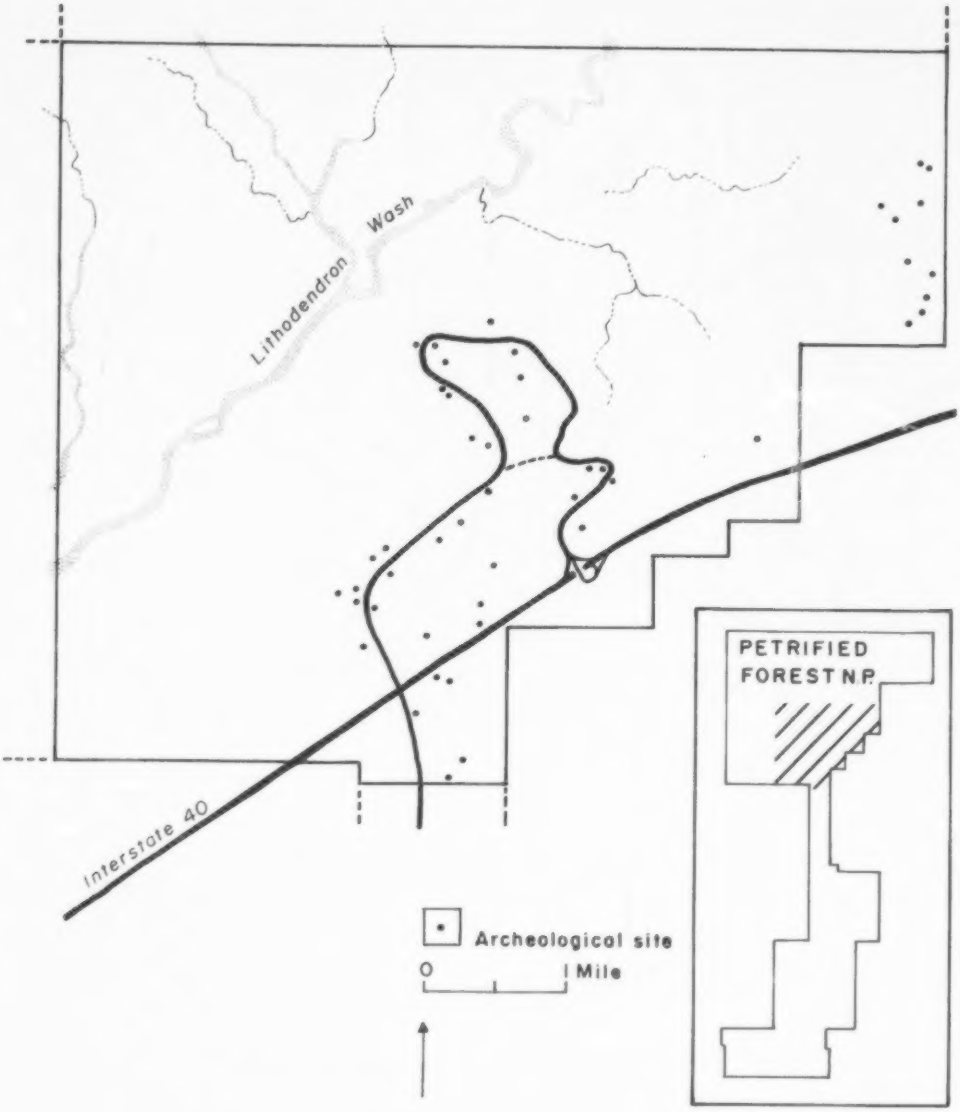
Lithodendron Wash
Interstate 40
PETRIFIED FOREST N.P.
Archeological site
0
1 Mile

Figure 6. Archeological sites in northern third of park.

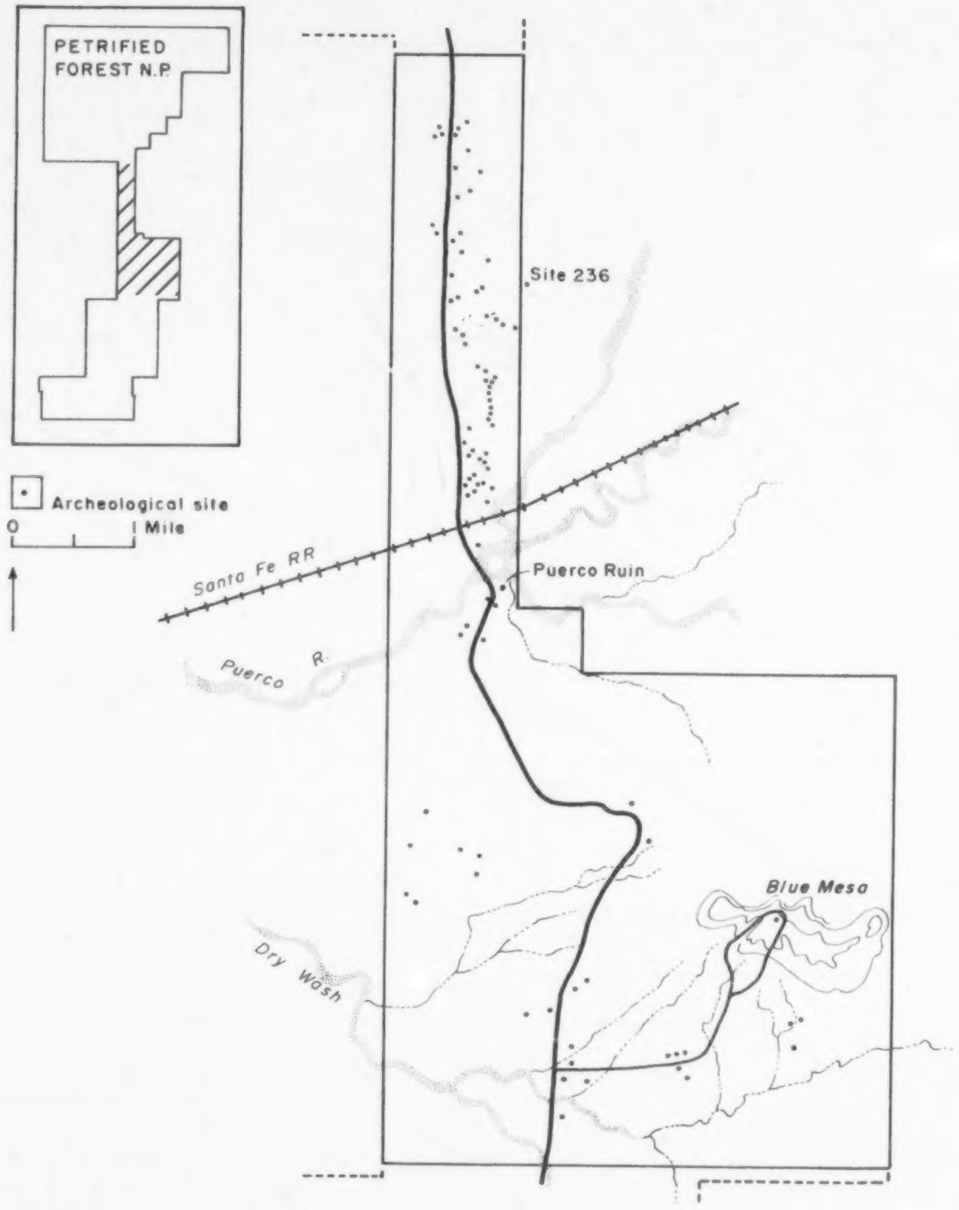
PETRIFIED FOREST N.P.
Archeological site
0
Mile
Site 236
Santa Fe RR
Puerco Ruin
Puerco R.
Blue Mesa
Dry Wash

Figure 7. Archeological sites in center third of park.

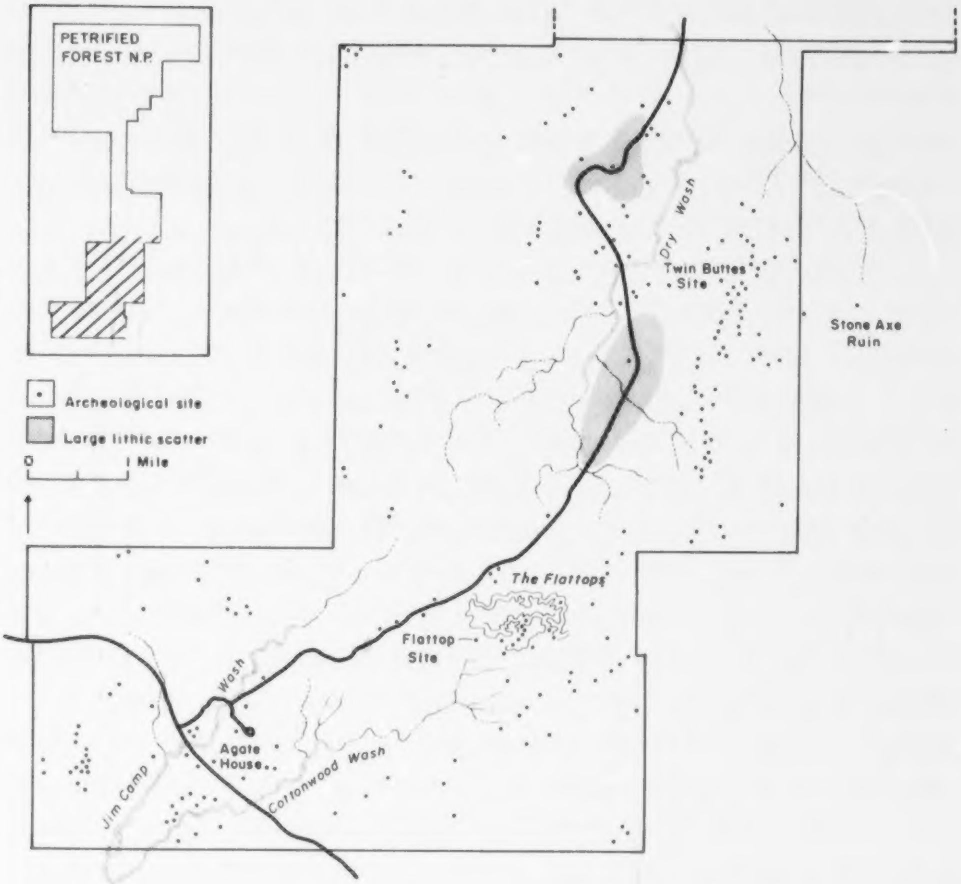
PETRIFIED FOREST N.P.
Archeological site
Large lithic scatter
0
1 Mile
Dry Wash
Twin Buttes Site
Stone Axe Ruin
The Flattops
Flattop Site
Wash
Agate House
Cottonwood Wash
Jim Camp

Figure 8. Archeological sites in southern third of park.

been recorded in western Early Man sites, but the use of brush structures and overhangs, or caves where they existed, usually is hypothesized. All kill sites have been found, owing to chance erosion or during earth moving, in deeply buried deposits. Sites contain the bones of 1 to 20 or more animals. The toolkit is limited and related only to hunting activities.

Site location varies with the method of killing, which, in turn, varies through time and between the three typological groups. This variation is not absolute; with each successive group a new method of hunting is added. Llano kill sites usually are found near marshes, sinks, bogs, playas or water courses, and animals frequently were killed one at a time. The exact method of killing varies, but a small group of men could have accomplished the task. A new technique, that of the hunting surround, was developed by Folsom hunters. Sites frequently are found at the ends of box canyons or comparable landforms for penning the animals so that they could be killed with projectiles. This technique requires the cooperation of several people, at least, and could have required several small, possibly family, groups for planning and execution. With Plano came the fall or jump hunting technique, possibly developed from the surround, that persisted through the late 1800s on the Great Plains. This method required extensive planning and cooperation and large numbers of people. Essentially, herds of game animals, most frequently the modern bison (Bison bison), were stampeded and guided over the edge of a cliff.

Among Llano and Folsom sites there is absolutely no evidence of subsistence techniques other than those for big game hunting, although some archeologists acknowledge a strong probability that opportunistic use was made of available fruits, nuts or berries. However, Irwin-Williams (1977) contends that both toolkit and settlement pattern bespeak a narrow subsistence range, totally unlike that of later hunter-gatherers, who made extensive use of gathered foods. With Plano a few small handstones and grinding stones are introduced into the toolkit, indicating the harvesting of seeds or other vegetal material and constituting the first hard evidence of an expansion of subsistence techniques to include plants (Jennings 1969: 71-109).

The evidence is so scanty and so damaged by erosion and time that inferences about social organization are difficult and probably will be overturned with the discovery of better preserved sites. Jennings (1969), on the basis of numbers of sites, kill techniques and tool typology, speculates that people during Llano moved as small family groups and that little beyond the knowledge of animal habits and extraction techniques for subsistence, and possibly for clothing, was required. The use of the surround technique with Folsom may have required a gathering of family groups, certainly a larger family group, with consequently more complex group planning. During Plano numbers of sites increased and hunting techniques definitely required group planning and cooperation. The killing of large numbers of animals in one spot implies a knowledge of preservation techniques for the surplus meat and an acceptable group method of distribution of the spoils. Larger numbers of people living together or meeting for the kill and, possibly, a population increase are implied.

Two distinct units of distribution for Early Man sites exist in Arizona: (1) the extreme southeast and (2) the northeast within Navajo and Apache counties (Agenbroad 1967: 118-119). Wendorf and Hester (1962) consider the southeastern sites to be within the core area for Llano. While habitation and kill sites have been studied extensively in the southeastern unit (Haury et al 1953· Haury et al 1959; Hemming 1970), sites to the north consist only of single projectile point finds or surface lithic scatters of mixed Early Man and later Archaic components. Single point finds have been reported, particularly, from the Little Colorado and Puerco river drainages. Danson (1961) detailed four points (three Clovis, one Angostura) from the vicinity of Sanders. His classification is disputed by Agenbroad (1967: 114), who believes there are two Clovis and two Folsom points. Since Angostura is a type that falls within the Plano groups, this classificatory distinction is important in terms both of the types of sites and of the probable time of use of sites yet to be discovered within these river drainages. Olson (1964) reports an unfinished Clovis point broken in manufacture near Houck. A single Folsom point was found near Mishongovi and described by Gumerman (1966). Each of these artifacts was discovered by chance and brought to archeologists. As a result, no record of landform indicative of site type, associated artifacts (if any) or any other category useful for inference is preserved.

Wendorf (1953: 69-70) recovered a Folsom point made of local petrified wood in the backfill of a pithouse at the Flattop Site in Petrified Forest. The point was fluted on both faces. Two corner notches had been made after removal of the flutes, suggesting reuse of the point by the Basketmaker group at the site. The use of clearly local petrified wood is interesting and important because it implies stone quarrying by Early Man within or very near the park.

Slightly more descriptive are a group of lithic surface scatters discovered near Concho, Arizona, by Tully Thomas (Thomas 1952; Wendorf and Thomas 1951). The group, scattered about the countryside near Concho, consists of about 30 nonceramic sites. Nearby are several sites that contain ceramics thought to be left by later, temporary occupations. Three components--Early Man, Concho Complex (Archaic) and Basketmaker--are recognized. The three small Early Man sites were isolated from the other components and were located in sand blowouts, presumably the remains of dunes on which the artifacts originally reposed. Artifacts consist simply of points, identified by Wendorf as Folsom, which sometimes were associated with random flakes used as scrapers and knives. No faunal remains were associated. No excavations were conducted and methods of collection and analysis of surface finds prevented the revelation of anything beyond typology and the extension of known territory in which Early Man roamed.

A much larger (approximately the size of a football field) and more descriptive site was discovered southeast of St. Johns, Arizona, by Mrs. Leola Mineer, who made a provenienced surface collection of 30 whole and broken fluted points. It is situated on a broad, low ridge at the base of a mesa and overlooks a large valley. The site (LS-187, the Vernon Site) later was recorded, collected, test excavated and analyzed by members of the Southwest Expedition, Field Museum of Natural History (Longacre 1962, 1963; Martin and Plog 1973: 62; Longacre and Graves 1976). A simple random sample collection revealed two components: Early Man (fluted point), occupying primarily the northern section, and Archaic (Concho Complex), occupying primarily the southern section. Test excavations showed no subsurface material. Deflating topsoil had left the artifacts resting on the surface of a sand canopy overlying bedrock. Besides fluted points and fragments, artifacts in the Early Man component included burins, gravers and end scrapers. There were no faunal remains in association, no features and no datable material. Longacre and Graves (1976: 280) prefer to describe the fluted point occupation as non-Folsom. Like the fluted points described by Wendorf and Thomas (1951: 109-110), these vary from High Plains Folsom and are similar to other more westerly points. This variation may represent temporal or spatial distinctions. Several concentrations containing primary, secondary or mixed flakes indicate stoneworking activities, possibly functionally specific. On the basis of two unfinished fluted points from the Concho Complex component and the technological differences, Wilmsen (1970: 80) suggests that the double component site may represent a culture continuum. He suggests two groups of hunters at a time of technological change. Longacre and Graves (1976: 285) disagree. At present, no conclusive evidence exists.

Whether or not this slim evidence actually points to much utilization of northeast Arizona is an unanswered question. Eroding mammoth remains have been discovered in both the Puerco and Little Colorado drainages, but lithic and other faunal remains have not, as yet, been associated (Gumerman and Olson 1968). The investigation of more illustrative sites awaits the vagaries of erosion and thorough survey.

The Chopper-Scraper Problem. North American archeologists always have been interested in searching for a preprojectile tradition similar to those of the Old World Paleolithic, which would show evidence of man on this continent earlier than about 15,000 BC, the earliest date now accepted by most archeologists. By the late 1880s discovery of chopper-scraper sites and complexes began, most of them in the western U.S. Artifacts are crude, usually large and rarely consist of projectile points, knives or other specialized tools. Manufacturing technique is always that of percussion flaking. Warren and True (1961) excavated a stratified chopper-scraper site in San Diego County, California, with Carbon 14 dates of 6000 to 8000 BC. Warren (Jennings 1969: 70) believes these artifacts were made by big game hunters. Sharrock (1966) has shown that chopper-scraper artifacts in a clearly stratified site in Wyoming are quarry materials. Radiocarbon dates range from 6000 BC to 1400 BC.

With few exceptions, these sites and complexes have been collected or excavated without proper controls, are surface finds and are undated. Jennings (1969: 65-70) presents a fair discussion of arguments and problems for all points of view. He concludes, as do most archeologists today, that while present evidence does not rule out the possibility of a preprojectile stage of development in the New World (except, possibly, climatically), neither does present evidence indicate that it existed.

Krieger (1962, 1964) cites the Tolchaco Complex, with over 70 recorded sites located primarily along the gravel-covered terraces of the Little Colorado River, as one of more than 20 areas arguing for the preprojectile chopper-scraper tradition. This complex was first defined by Bartlett (1942, 1943) as a focus and described as "antedating Basketmaker-Pueblo." Artifacts are small and consist of keel-shaped scrapers, bifaces, crude hand axes, hammerstones, bifaces, choppers, flake tools and flakes. More than 80 percent of the flakes retain cortex. There are rare pottery sherds, which is not unusual for any part of the countryside. She interprets the sites as lithic quarrying and manufacture sites. Ascher and Ascher (1965) conclude that the "artifacts" from a Tolchaco site near Leupp are naturally broken and not manmade. Sharrock (1966) interprets the Tolchaco sites similarly, but believes that they are Anasazi and that Bartlett's tools are, in fact, cores. Keller and Wilson (1976), working on a road salvage project for the Museum of Northern Arizona, recently totally surface collected portions of a Tolchaco site (NA 11,912). In addition to the previously mentioned artifact assemblage, this site contained a Pinto (Archaic) projectile point and a pottery sherd. Analysis indicated that the site was used for lithic quarrying and preliminary manufacturing, with flakes rather than cores being removed from the site. Sharrock's conclusion that many of the "tools" are discarded cores was supported. Absolute dating was impossible. Keller and Wilson (1976) conclude that their analysis neither refutes nor supports a preprojectile stage. They suggest, as have others, that Tolchaco should be considered a site type rather than a manufacturing tradition.

The Archaic (circa 6000 BC to AD 300). The Archaic is now considered a general cultural stage in North America. The stage begins as early as 7300 BC in southern Arizona and lasts as late as the mid-1800s in the midwestern plains states. It includes a change in the subsistence base from one of big game hunting to one of extensive use of all available plants and animals. Technology was expanded to produce the wide variety of tools necessitated by the broader subsistence base. It generally is thought that a major factor in this culture change was climatic change, with the consequent extinction of big game. The change from big game hunting to Archaic is poorly documented and is not well understood.

The origins of the new stage probably were diverse and could be the result of change among the big game hunters or of movement into areas by people already using broader based techniques.

In the Desert West, the general Archaic has been defined and described as the Desert Culture (Jennings 1953, 1956, 1957, 1969; Spencer and Jennings 1965). The lifestyle is characterized as migratory, with frequent shifts in location as various plants and animals were ready for harvesting and with a very long annual round. Groups may have been small. Hallmarks include the use of ground stone for milling, basketry and a wide variety of bone, flint and other tools specialized for particular tasks, with variations between geographic areas. Diagnostic traits include, among others, cookery of mushes and cakes, fur cloth, woven sandals (or hide moccasins), atlatl and dart, pulpers, scrapers, wooden clubs and tubular pipes.

Cynthia Irwin-Williams (1967) classifies the Southwestern groups of the Desert Culture, beginning about 3000 BC, as Picosa, which she divides on the basis of typology, technology and inferred ecology into three groups: Southern, Western and Northern.

She sees two major periods: "(1) an early period with a suggested duration from about 2500-3000 BC to about 800-1000 BC; (2) a late period with a suggested duration from 800-1000 BC to about 200 BC-AD 1" (Irwin-Williams 1967: 446).

Picosa is characterized as the elementary unit from which the Southwestern cultures sprang and the earliest period of Southwestern unity. Like the rest of Desert Culture, the primary subsistence base was intense use of local plants and animals, with a seasonal round geared to availability and maturation. However, Picosa subsistence had one very important difference from the other Desert Culture groups--its agricultural beginnings. While probably not a very important addition in the beginning, the significance of domesticated plants lies in "(1) the necessity of restriction of annual movement, resulting in the creation of an annual base, and (2) the creation of the potential for further sedentarism" (Irwin-Williams 1967: 443).

Typology, technology and conformation to the ecology vary between the three sectors. Sites are located in caves and rockshelters, along lake shores, and on level areas near springs and streams. Camps are located in the mountains, on sand dunes, within alluvial valleys and on low mesa tops. General site characteristics include refuse middens and small burnt rock middens used in food preparation activities.

The early period in the Northern sector is represented by material from four excavated sites far north and east of the park and by surface collections of Concho Complex artifacts 30 miles south of the park in the White Mountains.

Stoneworking technology includes the use of both pressure and percussion flaking and of ground stone production. Chipped stone artifacts include projectile points, discoidal scrapers, cutting tools and denticulates, along with a few bifacial tools. Flake tools are much more common than are the larger, heavier core tools. This may reflect different tool requirements for different environments. Ground stone implements include slab metates with shallow basins and one-hand manos. Bone tools, especially awls, also are present.

Settlement pattern information shows larger, more permanent winter occupations in better protected locales. Summer occupations include mountain hunting camps and camps for collection of wild plant materials. Evidence is good for the widespread use of simple horticulture. There is no direct evidence about burial practices.

There is more information about the late period in the Northern sector, including excavations in the Hay Hollow Valley and Little Ortega and Laguna Salado lakes south of the park. Stoneworking technology continues as before. Projectile point styles change and more regional variation occurs. Chipped stone tool types change slightly, with reduced numbers of choppers and planes in some areas and a great increase in numbers of bifaces, especially ovoids, which may have been used as knives or projectile points. Grinding slabs now include deep basins and mano styles increase in variety.

There is good evidence for shifts in settlement pattern and subsistence in northern New Mexico. The type sites for the early period continue, but there is increasing movement into relatively more permanent sites in stream valleys. This may indicate an increasing dependence on and use of horticulture. One burial under a stone cairn has been excavated.

Known sites within the vicinity of the park are all classified as belonging to the Concho Complex, now considered to be a regional variant of Picosa. Least descriptive is NA 3936 (Sims and Daniel 1967), which after discovery by a meteorologist was subject to several periods of collection by both amateurs and professionals. The site is 9 miles west of Winslow on top of a butte. It contained several points, as well as numerous core and flake tools. Sims and Daniel describe the artifacts as typologically resembling the Western Pinto Tradition.

The Concho Complex originally was defined from a group of 30 lithic sites in the vicinity of Concho, Arizona (Wendorf and Thomas 1951; Thomas 1952). The original complex is poorly defined in relation to modern information. The method of collection precluded the extraction of any information other than very general tool typology. Points resembled Pinto-Gypsum, San Jose and Cochise culture. Accompanying the points were flake knives and scrapers, end and side scrapers, bifacial choppers, leaf-shaped blades, stemmed knives and expanded base drills. There was a lack of pulper planes (which is now known to be typical) and a scarcity of grinding tools.

Sites are large, covering up to two acres, and are situated on mesa tops or bluffs well back from major drainages. Wendorf suggests that these are hunting sites. Both the lithic assemblage and the site locations bespeak hunting. No excavations were conducted. Soils and geological contexts suggest a date later than

6000 BC.

Two beach sites, both located on the edges of playas southwest of Concho and tentatively assigned to the Concho Complex, were systematically surface collected and partially excavated by members of the Southwest Archeological Expedition (Martin and Rinaldo 1960). The sites were near Laguna Salada and Little Ortega Lake. Both are considered campsites, owing to the lack of any sort of architecture. Artifacts show typological similarities to Pinto, San Jose and Cochise industries. Technology includes percussion and pressure flaking, as well as ground stone. The assemblage exhibits a lack of scraper planes, but milling tools occur in quantity. While the lithic assemblages at the two sites are similar, a statistical difference apparently indicates similar activities but different emphases. Ten hearth areas, some with nearby small bone fragments, also were found. It is unknown whether the sites are contemporary. No dates were obtained from Little Ortega Lake. One C14 sample from charcoal beneath a hearth at Laguna Salada produced a date of 1503-114 BC.

Surveys in the same general area revealed small sites in locations ranging from the valley floor to "'tiers' on the sides of mesas." There was no visible architecture and lithic assemblages were similar to those reported by Martin and Rinaldo (Longacre 1964: 203).

Two later sites, the County Road Site and the Hay Hollow Site, were excavated by members of the expedition in the Hay Hollow Valley (see Fig. 1) near Vernon (Martin 1967; Plog 1974). Both contained an important new addition in settlement pattern information for the region: remains of house floors. While corn was recovered from the sites, the major subsistence emphasis still was on hunting and gathering. At the Hay Hollow Site a few sherds of crudely made brownware, the earliest known pottery in the region, were found. Lithic artifacts included projectile points, basin metates and cobble manos.

The County Road Site was occupied at about 1000 BC and contained four houses. The much larger Hay Hollow Site was occupied at about 200 BC - AD 200 and contained three major clusters of features, each about 100 ft apart. Within each cluster were one to three houses, one to three large pits (6-12 ft in diameter), and many small pits variously used for storage and hearths.

The Hay Hollow Site clearly illustrates the beginning of the transition from Archaic, with its migratory lifestyle, lack of permanent bases of operation, and intense exploitation of most biological resources, to a more sedentary lifestyle, with larger groups, permanent bases of operation and greater dependence upon horticulture. House floors with a community group of long duration, storage pits for surpluses or redistribution, pottery too heavy for constant carrying, and corn in association with the remains of an open site bespeak the transition.

Within the park, N. Hammack (1978) recorded three aceramic sites that she classified as Archaic. All are located on an eroded sand dune ridge reaching south from the Flattops area. They consist of sandstone slab concentrations, hearths, small secondary flakes and occasional sharp-angle thumbnail scrapers. Most lithics were manufactured from chert. An isolated San Jose style chert projectile point was found on the same ridge and may be related to these sites. Without excavation it is uncertain how these sites relate to those in the general region.

In summary, while it is assumed that Archaic sites will fit the general categories established by Irwin-Williams for Northern Picosa, there is very little regional information on this important period. Only one area, that near Vernon, Arizona, has been studied in depth, and it clearly reflects the beginning of transition from food collecting to food production late in the period. This area, however, is environmentally very different from the park. Only three Archaic sites of unknown function are known to be located in the park. Since no lithic sites were recorded in the park prior to 1976, it is likely that other sites will be discovered.

Basketmaker II (circa AD 1 to AD 500). Accompanying the transition in primary subsistence emphasis from hunting and gathering to agriculture and relatively permanent settlements is the phenomenon of increasing regional differentiation. The Lower Puerco River region is located in a geographic frontier between several major Southwestern cultural traditions and several regions or branches within these traditions (see Fig. 3). Groups affecting park archeology varied through time, but included at least the Sinagua, the Upper Little Colorado and Forestdale regions of the Mogollon, and the Chaco, Kayenta and Winslow branches of the Anasazi. Sites within the region display a blending of various aspects of these groups. Blending can occur in entire sites, in architectural units and in individual artifacts. It can be so extreme that individual architectural units and associated artifacts from a major cultural tradition lie adjacent to units from a different and readily distinguishable major tradition or subtradition. At various times this situation also exists in the Hopi Buttes region to the northwest (Gumerman 1969), the Forestdale region to the south (Haury 1940, 1941) and the Quemado region to the east (Bullard 1962). Despite these many influences, the Petrified Forest area has been considered under classification systems used for the Anasazi by all previous researchers and for practical purposes will be so considered here.

While both Anasazi and Mogollon apparently originated from Archaic precursors and were influenced in a variety of ways from Mexico (Irwin-Williams 1967: 453), they are clearly separable and evolved in different directions, at least partly as a result of their different environments (Jennings 1968: 250). The Anasazi are associated primarily with the high plateau and canyon country centered in the Four Corners area; the Mogollon with the mountainous region centered along the Arizona-New Mexico border. Both practiced agriculture centered on crops of corn, beans, squash and, later, cotton, but agricultural techniques were different and sometimes vegetal species differed. Most of the documented changes from hunting and gathering to agriculture occur in the Mogollon area. Both continued extensive use of native plants and animals, but the Mogollon are thought to have placed greater emphasis on hunting and gathering. Settlement patterns, probably partly reflective of social organization within the groups and partly reflective of differing environments, differed markedly until about AD 1100, when most of the Southwest exhibited a superficial areal uniformity. Until that time Mogollon settlements usually were small, long lasting and made up of unattached pithouses of varying shapes and sizes.

Mogollon villages exhibit no particular plan and are built in mountainous country, on mesas, bluffs or ridges, and usually are well back from the valley floor. About AD 1100 a major change in settlement pattern occurred, which included the shift from pithouses to surface structures, as well as a change in site location. This change was not consistent throughout the Mogollon area (Wheat 1955: 34-53; Bullard 1962: 99-184). A trend toward increasing convergence of the population into fewer and larger settlements along major drainages began. From AD 1300 to 1450 large towns exist only along two major drainages (Wendorf 1956: 23-25; Longacre 1964: 204-205). By AD 1450 the Mogollon had ceased to exist in the areas previously known. It is generally accepted that a part of the Zuni, and possibly of Acoma, pueblo was formed from remnant Mogollons.

Six branches or regional variants of Mogollon generally are recognized. They are San Simon, Mimbres, Black River, Forestdale, Cibola and Jornada (Wheat 1955). There is much variation between the branches. Mogollon ceramics are the earliest known in the Southwest. In the early periods they are characterized by brownwares and polished redwares. Later red banding, white slip, black-on-white wares and polychromes were added.

Although there is considerable variation within the tradition, by AD 700-900 the Anasazi were beginning the transition from pithouse to aboveground habitation units. By AD 900-1000 they were constructing the contiguous-room surface masonry structures that culminated in the spectacular cliff dwellings of Mesa Verde and the multistoried "apartment houses" of Chaco Canyon (Willey 1966).

Euler and others (1978) discern five major population or settlement pattern developments for the Anasazi:

> (1) the emergence of three principal geographic branches before AD 1; (2) population increase and geographical expansion after AD 550; (3) occupation of the upland areas of the western Anasazi area concurrent with decreasing populations in the northeastern part of the study area between AD 900 and 1000; (4) general abandonment of upland areas and concentration of populations along lowland water courses after AD 1150; (5) abandonment of the San Juan River drainage by Anasazi populations around AD 1300.

Researchers disagree in their division of the Anasazi into major and minor branches (see Colton 1939; Willey 1966; Bullard 1962; Euler *et al* 1978). At least San Juan, Chaco and Kayenta are recognized as major branches. Minor branches can include, among others, Virgin and Winslow. Anasazi ceramics include unpainted gray, black-on-white, black-on-red and polychrome wares.

Originally defined by Colton (1939, 1946, 1960), the Sinagua population originally was centered near Flagstaff, later moving south into the Verde Valley and Chavez Pass. While their origins have been disputed, the Sinagua can best be explained at present as an indigenous development well adapted to the peculiarities of their environment (Gilman 1976). Because only a few sites have been excavated, little more than descriptive information is available for the earliest phases. Between AD 500 and about 1060, the Sinagua lived in small settlements of pithouses. Individual architectural units varied between and within periods. With a series of eruptions of Sunset Crater in AD 1060 and the resulting increase in agricultural potential of the area came population growth, culture change and increased interaction with adjacent groups. Between AD 1125 and 1200 the same major settlement pattern changes occurred in the Sinagua region as had occurred in the

Anasazi and Mogollon regions: habitation structures changed from pithouses to large aboveground pueblos. The Sinagua population peaked in the Flagstaff area at this time. After AD 1200 population in the Flagstaff area decreased rapidly and shifted toward Chavez Pass and the Verde Valley (Southern Sinagua). By AD 1300-1350 the Flagstaff area was abandoned and all occupied sites of the Northern Sinagua were large pueblos in the vicinity of Chavez Pass (Gilman 1976).

In conflict with the above point of view is Schroeder's (1947, 1957, 1961) Hakataya concept. Much simplified, the early (Pre-Eruptive, before AD 1060) Sinagua pattern emerged from the general Hakataya pattern, which he feels included all the area between the Mogollon Rim and the lower Colorado River on the east and west and between the Gila River in the Phoenix-Florence area and the Grand Canyon. Post-Eruptive (after AD 1060) Sinagua in the Flagstaff area consisted of groups from adjacent regions, who moved in order to take advantage of the agricultural potential of the volcanic ash fall.

To repeat, the nature of the interaction between these groups in the Petrified Forest area has been addressed, for the most part, in a loosely descriptive manner. The nature of the processes involved in this interaction should be a major concern of future research within the park. This interaction is first observed during Basketmaker II, prior to AD 500.

More comprehensive information exists for Basketmaker II within the park than for most other periods. Based on the numbers of recorded and excavated sites in the general region, particularly in the park and along the Puerco River to the east, the possibilities of both full descriptions and processual explanations of this period seem very good. Although one of the traditional traits used in identifying Basketmaker II has been the lack of pottery, sites in the park are identified on the basis of the existence of Adamana Brown pottery. It is the earliest pottery in the park and is a brownware similar to Mogollon Alma Plain. However, it is made by the paddle-and-anvil method generally used by the Hohokam and Sinagua, as opposed to the scrape finish method practiced by both the Anasazi and the Mogollon. It is a well made, thin-walled type and was fully developed in a number of forms before it began to be used in the park (Wendorf 1953). The type has been dated to AD 300 (Breternitz 1966: 68) at the Bluff Site in the Forestdale region of the Mogollon (Haury and Sayles 1947). A similar pottery from open Basketmaker II sites with surface structures has been documented in the Navajo Reservoir District, New Mexico, which contains some of the few large BMII sites with good absolute dates. These Los Pinos phase sites have been C14 dated to between AD 200 and AD 550 (Eddy 1961: 97).

There are 24 known Basketmaker II sites in the park. Mera's (1934: 2-4) survey documented four "colony" (village) sites, as well as "numerous" single pithouse sites that exhibited only Adamana Brown pottery. Reed's (1947) report on the pottery collected from his early 1940s survey in the park shows 13 "pure" Adamana sites, as well as 11 sites that he considers multicomponent because of the addition of pottery types considered to be later on the basis of pottery seriation (Appendix II: Table 4). Unfortunately, no researcher documented or analyzed all site characteristics as a group. Reed (1940: 22) mentions that the earliest inhabitants of the park

> lived in small, scattered villages of circular pithouses or slab houses -- dwellings consisting of shallow excavations in the ground, lined with stone slabs and covered with more or less dome-shaped walls and roofs of poles, brush, and mud.

Wendorf (1953) states that most of the sites that he saw with Adamana pottery were located on high, defensible bluffs.

In an effort to discover more about the early sites in the park, Wendorf (1953) excavated the Flattop Site (one of Reed's pure Adamana sites) in the southern section of the park (see Appendix I). Because of conflicting information, Bullard (1962: 63) has called this site an "orphan of Southwest archeology." It is very large for its period, second only to Morris's (Morris and Burgh 1954) pithouses near Durango, Colorado, which are not contemporary with each other. It consists of a village of 25 known slab-lined pithouses distributed primarily around the eastern edge of the top of the southernmost of the high Flattop mesas. Eight houses were excavated. Architecture revealed a mixture of Anasazi and Mogollon traits. Houses were shallow, were excavated into bedrock and were circular to oval in outline. There were no formal interior hearths, and the slab-lined exterior hearths do not work out to one hearth per structure. Most were small (2 to 3 m diameter), but House N was larger and interior features suggested its use as a "great house," although it was smaller than those known further south (Wendorf 1953: 46). Superstructures were brush and mud supported by juniper logs. Along with the remains of cottonwood, juniper and reeds, several small corncobs were recovered. Few faunal remains were recovered, although preservation possibilities were excellent. Chipped lithics, including a number of points, were similar to those from Basketmaker II sites in rockshelters in the Four Corners area and to those of the San Pedro stage of the Cochise Culture Archaic in southeast Arizona. Ground stone metates usually were troughs with rests (similar to Utah-type metates) and manos were subrectangular rather than the basin and oval types expected. This information is in direct conflict with Mera's (1934) observation that slab metates were associated with Adamana sites.

No absolute dates were obtained. Wendorf at first considered the site to be Basketmaker II, but later decided it was early Basketmaker III, partially because of the existence of pottery. He considered the site to date to before AD 500, as do more recent publishers (Gumerman 1969; Bullard 1962). Although the site yielded datable charcoal, the use of C14 dating techniques had not yet been widely adopted. The site also contained well preserved juniper logs that could, perhaps, be absolute dated using today's more advanced techniques.

Outside the park are a variety of sites classified as pre-AD 500 on the basis of tool typology, saucer-shaped pithouse floors and/or lack of pottery. All were discovered in the right-of-way for new highways, primarily Interstate 40. Nearest to the park is NA6588 on the Holbrook-Lupton Highway one-half mile east of the park boundary. Excavated by Breternitz (1957: 10-11), it consisted only of a slab-lined hearth and an unlined basin-shaped firepit, with accompanying ground and chipped lithics.

Much farther away, but still in the Puerco drainage, a pithouse village (NA8937) near White Mound Village was excavated under the auspices of the Museum of Northern Arizona (Gumerman 1966; Gumerman and Olson 1968). The village was situated on the valley floor in stable dunes. Remains were near the surface. Nine oval pithouses were excavated. House floors sloped steeply outward, perhaps owing to the erosion that left the site so near the surface. All houses had interior hearths. Pithouse 4 was considerably larger than the rest, with an alcove entry, ventilator shaft, ash bin and deflector. This house may be comparable to House N at the Flattop Site. Exterior features included bell-shaped roasting pits (which contained fire-cracked rock and sand), hearths and ash pits. Three kinds of ground stone metates--trough with open end, slab and basin--were recovered. Few chipped lithics but many hammerstones were found. There were no vegetal remains and few faunal remains.

Two unreported pithouses were excavated by John Cramer near Dilkon (Gumerman and Skinner 1968: 188). They were architecturally similar to those excavated by Gumerman, but contained little else for comparison.

What all this means in terms of the human population of the park is difficult to say, given the limited amount of recorded information. Because no lithic sites, limited activity sites or any other site type without visible architecture and without ceramics was recorded in the park prior to 1976, it is impossible to tell what the full range of activities may have been and whether or not

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sequential development occurred. It is obvious, however, that a significant population existed in the park sometime between AD 1 and AD 500. For the above reasons, it is impossible to say whether or not these sites represent a stabler form of an existing population, a population increase, an influx from one or more nearby areas, or some combination of possibilities. Certainly, both the architecture and the fully developed pottery, which occurs earlier than in more northerly sites, indicate interaction with several other groups.

Several hypotheses about Petrified Forest archeology, relating to pottery, architecture, the possible "great house" and general cultural pattern, were used by Schroeder (1961) to advance his Hakataya concept and must be addressed here. The Hakataya concept is concerned with origins of peoples who existed in much of the Southwest at the time of transition from the Archaic to more specialized groups, but particularly with the origins of the Hohokam along the Gila River near Phoenix, south and west of the areas previously discussed. Without going into great detail (for a complete discussion of the many points of view about Hohokam origins see Haury 1976: 351-353), Schroeder suggests that the Sinagua pattern observed in the Flagstaff area was derived from Petrified Forest, parts of which were derived via the Bluff Site and, before that, the Gila River area. Both the Petrified Forest and the Sinagua sites are undated, except by comparison, but there is a time difference of at least 100 years and possibly more. The patterns are similar, with architectural influences from the Kayenta Anasazi to the north and brown pottery made by the paddle-and-anvil technique (this is not Adamana Brown but both resemble Alma Plain). Schroeder may be entirely correct, and there is certainly evidence from several later periods of contact between the two areas, probably by way of the Little Colorado River. However, given the present evidence and because such a time difference is involved, it is equally possible that a frontier situation similar to that which produced the observable configuration at Petrified

Forest also produced that in the Flagstaff area. Such a circuitous route for derivation of the individual components of the pattern is not necessarily the case, nor is migration or direct contact between Flagstaff and Petrified Forest. This sort of problem really cannot be resolved without further directed research.

There is a definite increase in Basketmaker II site complexity over that described for the previous period. Numbers of pithouses, interior subdivisions within houses, the possibility of a "meeting house" and additions to the artifact assemblages argue for this. The number of houses that appear to be contemporary at the Flattop Site suggests more than one family group. This could also be the case at NA8397. However, Mera states that Adamana sites include both villages and single pithouses. The exterior hearth location, along with the lack of hearths at some houses in the Flattop Site, suggests a sharing of cooking activities, possibly among extended family members. This is not the case at the smaller and aceramic NA8397. The existence of possible "great houses" at both sites suggest the beginnings of a method for group cohesion and/or ceremonialism. Haury (1950) has suggested that Mogollon great houses were the precursors of great kivas. The combination of single isolated pithouses and comparatively large, apparently well integrated villages offers many possibilities. If not contemporaneous, we have a possible sequential development of villages and, perhaps, complexity or cohesiveness in social organization. If contemporaneous, we have possible seasonal convergence and dispersal of the population, perhaps for subsistence purposes, or a clustering and scattering of the population according to the ability of the land to support them within a given geographic range.

Common and primary subsistence bases during this period in the region need further study. Wendorf states that the primary subsistence base at the Flattop Site is agriculture, and both corncobs and trough metates indicate that agriculture was practiced. Pollen sampling for indications of economic plants was not in use in archeology and Wendorf was unable to check for seed remains. At that time, however, Mera's observation that slab metates were recovered from Adamana sites may be an indication that gathered foods were collected seasonally or during periods of stress. Considering that a number of projectile points were collected, the lack of animal bones at the Flattop site is perplexing. Wendorf suggests warfare and, because so little is known of this period, his suggestion cannot be completely overlooked. It is interesting to note that of the three large BMII sites excavated in northeast Arizona (Morris and Burgh 1954; Eddy 1961; Wendorf 1953), only those in the San Juan district near Durango, Colorado, yielded large amounts of animal bone that indicated their use as food (Jones and Farmer 1954). Both Wendorf and Eddy report that bone preservation is not a factor, because the soil was checked for its ability to preserve bone. At Gumerman's site there were no vegetal remains, but tool typologies suggest hunting, gathering and agriculture. These differences could be related to different site environments, seasonal use of sites or differences in ages of the sites. Whatever the case, future study of Basketmaker II sites in the park certainly should approach the problem of primary subsistence, particularly whether or not agriculture was the exclusive method or subsistence at such an early time as Wendorf suggests.

Basketmaker III (circa AD 500 to AD 700 or 800). There also is a dearth of information about Basketmaker III in the Lower Puerco River region. There is evidence of growth, both of numbers of sites and of people, of aggregation of parts of the population, of the beginnings of the transition from pithouse to surface dwellings, of contacts or influences from further afield, of trade, and of increasing intrasite complexity. However, because there has been no work in recent years to integrate newly acquired knowledge and because earlier methods of recording and analysis are so different from those used now, it is possible only to surmise what may have been happening.

Published information from the park survey is conflicting. Reed (1947) lists about 65 sites, either multiple or double component, which probably are Basketmaker III, while Wendorf (1953: 19-20) lists about 40. At any rate, a definite increase in numbers of sites is demonstrated.

The extent and variety of village plan and size is unknown. Reed (1956) has suggested that most of the sites of this period are quite large, but Wendorf (1953: 21) had difficulty locating a site large enough to give him what he considered an adequate sample for excavation. After a season's excavation at the Flattop Site, he located the Twin Buttes Site, the largest village of its period in the monument, which had not been recorded by the survey. He had previously located an unknown number of sites.

The Twin Buttes Site (Wendorf 1953; see Appendix I) is the only excavated Basketmaker III site within the park. It is located at the base of a mesa at the edge of a broad flat valley. It consists of scattered house groups, situated along the flats, on the tops of stabilized dunes and on one of the small bentonite buttes attached to the mesa, as well as a system of disjointed rock alignments running straight up the southeast side of the sand dune climbing the butte. House groups showing BMIII surface pottery extend for a way along the base of the cliff and for a quarter of a mile into the valley.

Wendorf identifies the site as Late BMIII and assigns it to the White Mound phase of the Chaco branch of the Anasazi. Less than 1 percent of the central site area was excavated. A deep stratigraphic test revealed a lowest level occupation that included large adobe granaries similar to those found in Basketmaker II occupations of rockshelters far to the north, a variety of pits excavated for unknown reasons, a portion of a pithouse, and Adamana and other pottery. Excavation of the trench progressed in 25-cm levels. It is not clear which pottery types are associated with Adamana at the lowest level (compare Fig. 47, 67, 68 and 69 in Wendorf 1953). There was evidence of rebuilding in both the stratigraphic tests and in house group excavations. Pottery types excavated show a datable range now known to be from AD 300 to about AD 800-900 (Breternitz 1966), with the earliest being stratigraphically lowest. In other words, not all of this site was occupied at the same time, and it is unknown which parts were occupied together. Evidence points to an occupation from Late Basketmaker II-Early Basketmaker III through Early Pueblo I.

House groups, determined by surface evidence, usually have a loosely crescentic arrangement, with semisubterranean storage units forming the crescent and with a deep pithouse in the concavity--the beginning of a "typical" Anasazi village unit. Isolated storage units and cists also were discovered. This is the Late Basketmaker III-Early Pueblo I occupation of which Wendorf speaks. Only one pithouse in such a unit was excavated; it may have been used both as living quarters and a kiva. Surface or partially subsurface storage rooms showed evidence, including firebuilding, of use for both storage and living. Apparently, the transition from pithouse to surface dwellings had begun, along with the transition from pithouse to kiva.

Burials, the earliest discovered in the park, were located next to the agricultural stone alignments. There were associated gravegoods, including shell ornaments, turquoise, netting, fur cloth, possible twining, vegetal remains and pottery.

Many of the gravegoods and several other artifacts indicate trade of an unknown nature. Both turquoise and obsidian had to be traded, and there are methods now for tracing both to exact sources (Colberg-Sigleo 1970, 1975; Stevenson _et al_ 1971; Jack _et al_ 1969). The shell originated both in the Gulf of California and on the West Coast. Pottery is less conclusive. Wendorf (1953: 127-128) feels that all brownware (about 40 percent of site total) was traded into the site and that brownware was associated with burials because it was valuable. Shepard (in Wendorf 1953), who performed limited tests on the brownwares and compared them to collections from both the Bluff Site (Haury and Sayles 1947) and the Bear Site (Haury 1941) in the Forestdale Valley, discusses four possibilities, including various types of trade and local manufacture. All need further study, hinging primarily on clay sources, temper sources and comparison of various similar pottery collections known to be of local manufacture. Shepard's analyses revealed two facts extremely useful for further archeological studies of early sites within the park: (1) the brownware and the grayware found in the park could not possibly have been made from the same clay sources and (2) unlike many brownware sequences, this ware shows four separate tempering materials with chronological correlations. The most recent pottery in the sequence (identified as Forestdale Plain) is brown with grayware sherd temper. Shepard (1953: 193) concludes her study:

> There is nothing inherently impossible in the hypothesis that Anasazi people moving into territory where they could not find the kind of clay they were accustomed to using, ceased making pottery and obtained some in trade from their homeland and some from the Mogollon people.

Both Wendorf's and Shepard's hypotheses are significant for general Southwestern archeology. They infer large scale trade at a very early period. In light of these hypotheses, it is interesting to note that Art Trevino (1975: personal communication), then a graduate student in geology at the University of Arizona who did geological work in the park for about a year, knew of no clay sources within the park suitable for use in pottery making. He stated that bentonite, which exists throughout the park, shrinks too much in drying. This should be tested in replication studies, and possible clay sources within and near the park should be searched for.

Since there are no studies of this sort, it may also be possible that an idigenous population, having no proper clay resources when pottery began to be used nearby, imported what was needed from other areas. It is, of course, possible that there are unknown clay sources in or near the park. Checking the sources of pottery and all other trade items is of primary importance in discovering the real nature and character of the prehistoric population within the park.

Wendorf feels that agriculture was the primary subsistence technique practiced at the site. In addition to charred corncob remains recovered from a number of structures, he advances a number of quantifiable hypotheses concerning agricultural techniques, water use and available land (see Chapter 1). Earliest levels at the site revealed both huge adobe granaries and a rock alignment believed to be an earlier example of surface rock alignments discussed above in connection with sand dune farming techniques. No gathered vegetal remains were searched for. Animal remains were primarily of antelope, together with rabbit, eagle, dog or coyote, and turkey (found in a ceremonial burial context). Present evidence, then, indicates a primary subsistence base of agriculture supplemented by hunting.

The artifact inventory increases and indicates an increase in number and types of activities at the Flattop Site. Besides those new articles mentioned in connection with trade and burials, artifact additions include mauls, grooved axes and stone bowls. Pottery forms and types increase. General affinities are to Chaco Anasazi, northern Mogollon and, to a lesser extent, Kayenta Anasazi.

Once again, nearest sites probably equivalent in time are far flung and exhibit a variety of characteristics. To the east in the Puerco River Valley a variety of sites assigned to three different phases (Lupton, La Plata and White Mound) coincide chronologically, at least in part, with those at Petrified Forest. Gumerman (1968) discusses aspects of two of these phases on the basis of work done by Gladwin (1945) and Wasley (1960):

> The introduction of ceramics into the region marks the beginning of the Lupton and the La Plata phases. There are some interesting problems which revolve around these contemporaneous phases. The La Plata phase is identified with the original description of this Basketmaker III manifestation in its northern form ....

> Apparently at the same time, but in separate villages, a group was present in the Puerco which, in their preference for brownwares of a Mogollon cast, suggest a southern origin. Wasley, who terms this complex the Lupton phase, places its beginning somewhat earlier than the La Plata phase; however, the two phases coexist after approximately AD 500.
>
> It is apparent that the boundaries between gray-and brownware-using peoples is not as clear as once thought. This seems particularly true at early time levels. If trade in ceramics is any indication the two groups seem to have been in frequent and peaceful contact. Definite brownware sites, which could be assigned to this phase or later ones, have not been found yet as far west as Houck, but brownware, both plain and smudged, is a low percentage intrusive throughout the entire span of occupation. Our excavations suggest that after the Lupton phase the ceramic border shifted farther south and that perhaps centers of exported ceramics also changed.

Gumerman did excavate evidence of the later White Mound phase (AD 750 to 850) near Houck. There was great architectural variety, but most pithouses were deep. Wing walls existed in some. Some pithouses also had alcove entries rather than ventilator shafts. Surface rooms, however, did not exist, but this pattern does show up in later phases. The only intrusive ceramics during this period were several types of thin and well finished brownwares attributed to the Petrified Forest or Forestdale regions. About 40 miles northeast, directly up the Puerco River, Gladwin (1945) excavated a Basketmaker III-Pueblo I site at White Mound on the north bank of the river. The site is assigned to the White Mound phase of the Chaco branch of the Anasazi (Late Basketmaker III) and partially includes the Kiatuthlana phase (Early Pueblo I). It is small (100 yd^2 before excavation). Both the artifact assemblage and the intrasite settlement pattern are similar to that found at the Twin Buttes Site. Here storage rooms are arranged in a straight line but are attached with pithouses in front. In the spaces between pithouses and storage units were found remains of platforms and brush shelters, assumed to be outside work areas, and isolated storage cists. Storage rooms showed no signs of other activities. Pithouses definitely were lived in, but had many accoutrements of kivas from other areas. Houses show a building sequence with only some of the houses being used at the same time. Pottery style affiliations are to Chaco, Kayenta and Mogollon. Gladwin concludes that there were two groups of people living together.

Slightly further east, near Lupton but still on the banks of the Puerco River, Wasley (1960: 32-37) excavated three sites with Basketmaker III components in the projected right-of-way for Interstate 40. Arizona K:12:6, K:12:8 and K:12:10 all exhibited the now familiar "blending" of Anasazi and Mogollon characteristics. The Basketmaker component of the sites was small, ranging from one to nine structures, including pithouses and storage units. Architecture was variable. A burned pithouse in K:12:8 resulted in the preservation of several perishable items: sandal fragments, a jar full of prickly pear cactus, shucked corn in a seed jar, shucked and unshucked corncobs, and a piece of wood weaving tool. At K:12:6 there was a marked contrast between the pottery types within the three pithouses. Wasley suggests chronological differences, but it could also mean functional or relational differences.

Also near Lupton, Ferg (1978) excavated Arizona K:12:3, originally located by Wasley and again recorded by L. Hammack. The site was excavated prior to construction of a rest area along Interstate 40. Arizona K:12:3 has a prehistoric White Mound phase component and a historic component. The White Mound phase occupation is dated to about AD 800. It consists of a pithouse, four associated and contiguous surface rooms, isolated hearths, burials and extramural work areas. The surface rooms had been used for purposes other than storage. There were possible functional differences between types of hearths. The inhabitants practiced a mixed subsistence pattern that included the use of both cultivated domestic plants, such as corn and beans, and wild game, including mule deer, cottontail and jackrabbit. Remains of a turkey egg and of prickly pear also were recovered. Ferg concludes, as did Wasley, that both Anasazi and Mogollon-flavored cultures existed side-by-side in the area and that perhaps some settlements were the result of migration. He delineates the probable farthest extension of Mogollon in the immediate region during Basketmaker III. He also suggests dropping the use of the La Plata phase in the Puerco River Valley.

To the south in the Hay Hollow Valley, Plog (1974: 38-39) reports about 40 sites belonging to this period (Phase III, Hay Hollow Valley). Sites consisted of a series of loci, composed either of pithouses or of limited activity units. Settlements fell into two categories: those with one or two houses and those with 10 or more houses. Larger settlements were about 4 miles apart, with smaller ones scattered in between. Topographic location was on the valley floor. Plog suggests centralization with either organizational centers or seasonal changes in settlement pattern. One site, the Gurley Site, was excavated. Here again, a kiva seemed to have been used partly for ceremonial purposes. Habitation rooms became more specialized for certain activities, as were outdoor use areas between structures. Pottery is Mogollon, Kayenta and Chaco.

In the Hopi Buttes area northwest of the park the situation is drastically different. There is a severe environmental contrast, with less water, more general desiccation, an apparently smaller population through time and a confirmed lack of environmental change through time (Gumerman and Sutton 1967; Gumerman and Skinner 1968; Gumerman 1969). In a reconnaissance survey of a 25 square mile area, Basketmaker III sites were the first to appear. Three sites of this period were located. Three houses, forming one component of a multicomponent site, were excavated. The excavated site (Finger Rock, NA 9192) is situated on a low sand ridge. Structures were on the surface and had a brush superstructure. Gumerman, noting that these structures would be judged temporary in other areas, feels they were permanent at this site because of the amount of trash. Other structures included roasting pits and a storage pit. Pottery affiliations are to Kayenta, with about 20 percent being similar to Chacoan or Cibolan wares along the Puerco River. There also were a few Mogollon sherds.

In summary, Basketmaker III in the wider area seems to be generally a time of transition and growth. The trend in intersite settlement pattern appears to be toward centralization of an unknown sort, with smaller outliers or intermediary settlements. Intrasite settlement pattern includes loose arrangements, tending toward more formal arrangements later. Structures were becoming more functionally specific. Trade was occurring on an unknown, but possibly large, scale. Kayenta, Chaco and northern Mogollon pottery affiliations predominate and functional differences occur. Agriculture seems to be the primary subsistence technique, but there are indications of both hunting and gathering, which have never been quantified. Social organization has not been studied, but the above trends suggest greater complexity and a good chance of more formality. There are unknown mechanisms (trade is most likely) for interaction among communities.

Pueblo I (circa AD 700 or 800 to AD 900 or 950).

At this point, archeology within the park faces its second major typological problem. Many archeologists (especially Brew 1946; Reed 1956) have commented on the similarities between Basketmaker III and Pueblo I. Differences really exist only in the early parts of the former and the final parts of the latter. During this period there was tremendous variability among Anasazi settlements, especially in architecture. Indeed, distinctions are made primarily on the basis of ceramics and the period has validity only in the San Juan "heartland" (Jennings 1968: 271). This seems to be the case where the park and most adjacent regions are concerned. Aside from changes in the ceramics, a slow trend toward stereotyped intrasite patterns and conversion of pithouses to kivas seems to occur during late Basketmaker III - early Pueblo I. Toward the end of Pueblo II, a different settlement pattern emerges.

Early reports (Mera 1934; Reed 1940a) state that surveys within the park revealed no Pueblo I sites. Wasley (1960: 32) acknowledges the same was true for the Lupton (Upper Puerco region) area. Reed (1940a) very shortly thereafter refuted his early point of view, stating:

> The virtual absence of Pueblo I in the Petrified Forest is more apparent than real. These periods are determined almost entirely by pottery types, black-on-white and polychrome, which are intrusive in the Petrified Forest rather than locally made; probably there was a temporary decline of trade between 700 and 900, with certain of the sites labeled 'Basketmaker and Pueblo II' extending forward and backward, respectively, into this period.

Trade in pottery still is unquantified within the park, but sites continue to be assigned to one stage or another on the basis of pottery dated in other places. Wendorf (1947), on the basis of analysis of pottery apparently acquired early in the survey, assigns four sites to Pueblo I. N. Hammack (1978; see Appendix I) recorded PI-PII sites together on the basis of pottery typology. Ten sites in this category were identified.

The lack of Pueblo I sites noted by both Reed and Wasley points to (1) no "pure" Pueblo I sites within the park and (2) no new sites in early Pueblo I. As discussed above, this suggests a continuum from late Basketmaker II - early Basketmaker III until an unknown time in Pueblo I, with a gradual refinement of the same procurement and intersite and intrasite interaction systems. It has several alternative implications as well: (1) that the environment stayed essentially the same, probably favorable for the type(s) of agriculture practiced during this period, and later changed enough to necessitate a change in agricultural techniques, settlement pattern and possibly social organization; (2) that agricultural techniques, as suggested by Wendorf (1953), reduced the production value of the land and lowered the water table in the vicinity of the existing sites to such an extent that a change in settlement pattern was necessary; (3) that until this time gathering was practiced to a much greater extent than was previously thought and, as agriculture became more important, it was necessary for smaller groups to move into environmental niches that would support this subsistence technique; (4) that the population expanded to such an extent that movement of many groups to new areas was necessary, and (5) interaction at a larger community level involving, perhaps indirectly, at least the Chaco region and the Mogollon. Further implications are discussed below under Pueblo II.

Whatever the case, present archeological information provides no basis for arriving at answers to these questions within the park. Other than a portion of the Twin Buttes Site, there are no excavated PI or PII sites in the park. With the exception of the Pueblo I aspects of the Twin Buttes Site, all information comes from outside the park.

Significant for its apparent similarity to the park's archeology and for its clear demonstration of Basketmaker III - early Pueblo III transitions in site location, intrasite settlement pattern and functionally specific areas is the Whitewater district (Roberts 1939, 1940) on the south bank of the Puerco River near Allentown. Favored locations within each stage were different, but excavated material exhibits a clear stratigraphic sequence. Roberts excavated in only a small part of this major complex, primarily within Pueblo I remains. However, excavated portions also included Basketmaker III dwellings, which had been so badly disturbed by later inhabitants that not much more than the fact that they existed could be recorded, and several Pueblo II type dwellings, together with accompanying outdoor and ceremonial features. The Pueblo I occupation is slightly later than that at White Mound. The stratigraphic sequence reveals the change from pithouses to kivas and from storage rooms to the surface units of Pueblo II. Pithouses pass through an interim period when they have kiva accoutrements, sometimes including full benches and pilasters, but they still are used for dwellings. Concomitantly, surface storage "granaries" were used partially as domiciles before conversion to houses. Drawing his conclusions on the basis of his previous extensive excavations at Shabik'eschee Village in Chaco Canyon (Roberts 1929) and at Kiatuthlana (Roberts 1931) and Village of the Great Kivas (Roberts 1932) on the Zuni reservation, as well as settlement pattern, pottery sequence and an excellent tree-ring series, Roberts (1940: 136-140; 1939: 136-140) decided that the Whitewater district at a very early date shows a clear and strong direct influence from the Chaco region. Further, there is at first a noticeable time lag between occurrences at Chaco and those in the Whitewater district, but the lag becomes increasingly shorter until Pueblo III, when hardly any lag exists. He suggests extensive travel up and down the Puerco and across to Chaco. He concludes also that Kayenta influence on this region was slight and began later than that from Chaco. He also feels that, contrary to the then popular belief that the Little Colorado area (he is referring here to the Petrified Forest area and most adjacent territories) influenced both the Chaco and Tularosa (New Mexico) regions, indications are that influence was always from the Chaco region and that there was interchange between the Chaco and Tularosa regions before those involving Whitewater and Tularosa. Variations and refutations of this point of view have been frequently bandied about (see Colton 1939; Gladwin 1940; Wendorf 1953), but the question has not been resolved.

Gumerman and Olson (1968) discuss two Kiatuthlana phase sites excavated on a bluff north of the Puerco Valley near Houck. They note that no sites of this age have been found in the valley, but that they are common on high ridges both north and south of the valley. Both the Kiatuthlana type site (Roberts 1931) and the Pueblo I components excavated at Whitewater were similarly situated. They note also that an unusually large proportion (about 75 percent) of the painted pottery wares are Kana'a Black-on-white, which is more common in the Kayenta and Little Colorado regions than is a high percentage of Chaco wares. This is unlike the situation at Whitewater, and Gumerman and Olson consider this an east-west border area.

To the west, Breternitz (1957:8-10, 13-16) excavated two Pueblo I sites in or near the right-of-way for U.S. 66 between Winslow and Chambers. The sites are small, consisting of one or two pithouses of various shapes. Pottery affiliations are with Mogollon, Chaco and Kayenta. One site contained evidence of much hunting, including the bones of dog or coyote, mature and immature cottontail, jackrabbit, antelope, prairie dog and turkey (including pieces of eggshell).

In the Hopi Buttes area Gumerman (1967: 188-189; 1968: 55-57) recorded seven Pueblo I sites, three of which were excavated. Excavated portions were all components of sites that also contained later components. Structural units are all pithouses in a variety of shapes and with various interior accoutrements. As is the case throughout the prehistory of the Hopi Buttes region, while correlations can be made with the culture history of adjacent areas, site density and choice of structure type appear to relate directly to the much more severe environment found there than in the surrounding regions. Pottery affiliations at three sites clearly are with Kayenta and Mogollon.

To the south in the Hay Hollow Valley, Plog (1974: 39) reports an apparently similar situation in his Phase IV. The only excavated site was one for limited activities. However, about 40 sites from this period are known. They include both underground and aboveground units. Pottery is diverse. The trend is away from centralization.

Pueblo II (circa AD 900 or 950 to 1050 or 1100). Pueblo II has been characterized as a time of settlement pattern change, decrease in site size and a general increase in areal extent of the population (Willey 1966: 207-208; Jennings 1968: 272-274). Some possible occurrences in Pueblo II are discussed above and it is obvious that causes are not clearly understood. Jennings (1966) discusses an aspect, taken from ethnographic analogy, not previously considered here:

> But credit must also go to the Anasazi family or lineage farmstead pattern of life. Small ruins occur by the thousands wherever there was water to put on the fertile soil; thus, the population spread as family after family 'hived off' to make new stands and the culture spread far beyond the favored areas where the land supported heavy aboriginal use.

During this period the last new cultigen strains before historic times were added and after this period there are no new additions to the artifact inventory.

Again, Pueblo II within the park is defined on the basis of seriated pottery types. Using Reed's (1947) sequential pottery characteristics to date located sites, an unequivocal change in settlement pattern is shown. However, early surveys list no information about site size, situation or any other aspect besides pottery type. Reed (1947: 15-16) lists 54 "pure," or single component, sites (see Appendix II). He lists his sites in such a way that it is difficult to obtain exact numbers, but there are more than 100 sites with Pueblo II components, most of them extending into Pueblo III. A few have earlier components. N. Hammack recorded 10 PI-PII sites (see above). There are no excavated sites.

In 1975 I recorded an unusual site just outside the eastern boundary of the park (Fig. 9). This site (No. 236) had previously been recorded by park personnel, but was not mapped or collected. It is situated on the edge of a steep promontory of a wide mesa overlooking the valley of Dead Wash. The site consists of a small pueblo that appears to be preplanned and an assumed dance court. The pueblo contains a block of at least five rooms and, perhaps, two kivas, one of which may be of circular adobe inside a rectangular stone room. Several rooms on the northwest corner may have been two stories high. To the south is a probable plaza configuration. The dance court is 18 m in diameter, is lined with very large upright sandstone slabs and has an extended slab-lined entryway that faces generally east. It is depressed about a meter

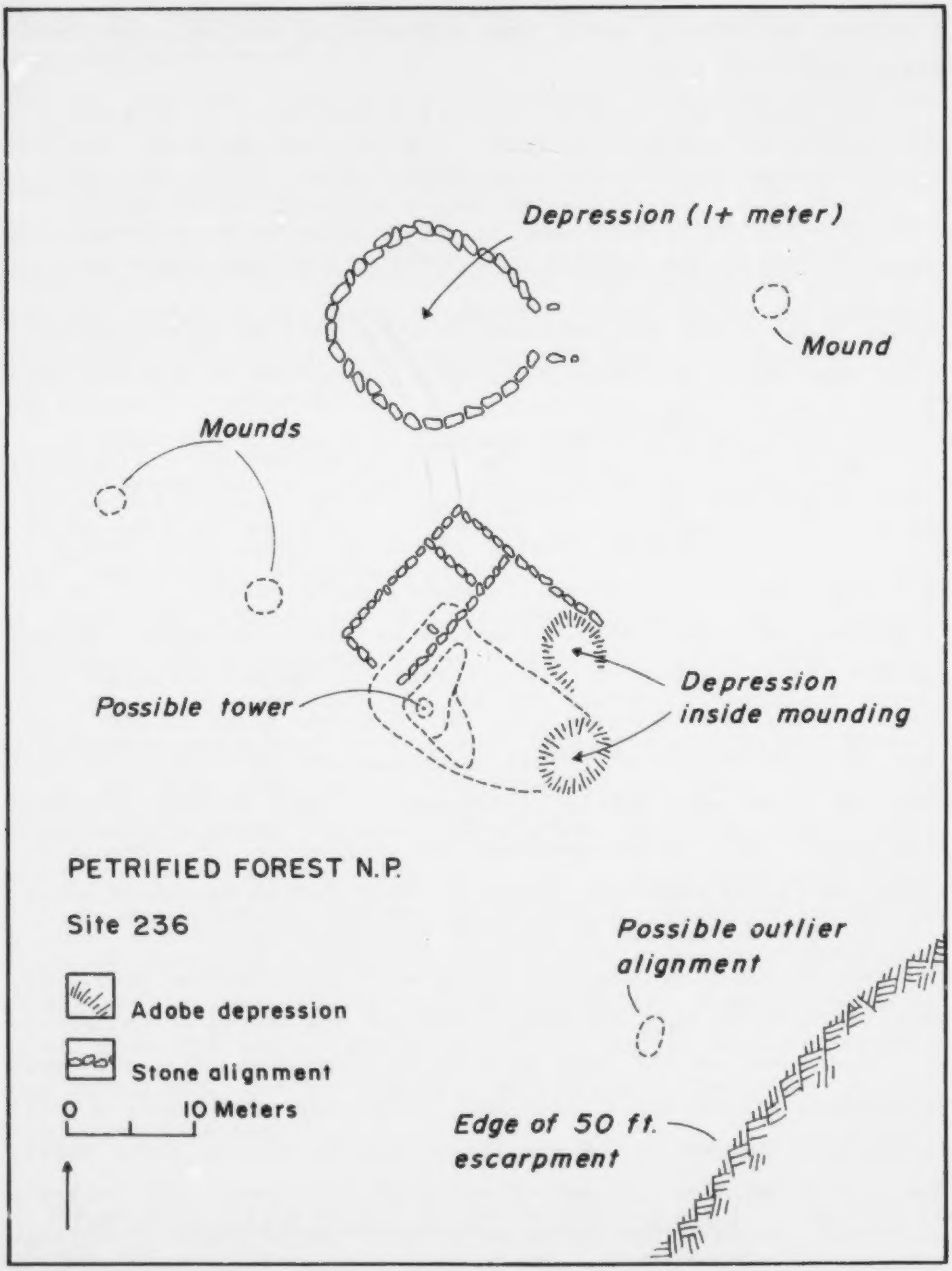
Depression (1+ meter)
Mound
Mounds
Possible tower
Depression inside mounding
PETRIFIED FOREST N.P.
Site 236
Adobe depression
Stone alignment
0 10 Meters
Possible outlier alignment
Edge of 50 ft. escarpment

Figure 9. Plan of Site 236.

from the present ground surface, except at the northeast end, where the exterior ground level is higher. Several small low mounds are nearby. The only pottery or other artifacts on the surface lay on or very near these features. Collected pottery was identified by Laurens Hammack of the Arizona State Museum as Pueblo II, dating between AD 1000 and 1100. It is possible that only the mounds date to this period.

In the Whitewater district, Roberts (1939, 1940) excavated Pueblo II components consisting of three unit-type pueblos and associated kivas, along with a great kiva and an unusual associated structure that he describes as a dance court. While not unique, very few dance courts are known in the archeological literature (see Roberts 1939: 126-128). Roberts does not specify the basis on which he identified the court as Pueblo II. The court was not excavated, but had a raised platform at one end. It is only 57 ft from a Pueblo III structure, which again appears to be very similar to, but much larger than, the associated pueblo at Petrified Forest.

A well known dance court of exactly the same size as that at Petrified Forest is adjacent to Wupatki Ruin (NA405), a Sinagua site about 45 miles north of Flagstaff. This pueblo has been tree-ring dated at AD 1073 to 1230 (Gilman 1976), assuring only a slight overlap in time, if any, with the site at Petrified Forest (that is, if the pueblo and dance court components are, in fact, PII). The associated pueblo is quite large and several stories high; the dance court is not constructed in the same manner. These structures are discussed further under Pueblo III.

Nearby, Gumerman and Olson (1968) excavated an unknown number of sites from the Red Mesa (early PII) and Wingate (late PII) phases. Aboveground structures used for habitation rather than for storage occur for the first time near Houck in the Red Mesa phase. Definite kivas also appear, but a "front-oriented" settlement pattern has not yet stabilized. Pithouses also occur in this phase, but the authors do not state their context. They are usually deep, square and incorporate features from both above- and belowground structures. These pithouses are considered transitional. Gumerman and Olson consider sites in this phase parochial.

Front-oriented villages with a room block, a kiva in the plaza and a trash area beyond appear in the Wingate phase. The sites are on the north side of the river and always face south. The kiva in the plaza sometimes is situated in the southeast corner rather than the center, which is unusual. Sites are small, consisting usually of fewer than 10 rooms. One kiva was painted in simple designs of black and white; the authors state that locals say others exist in the area. Black-on-red wares occur for the first time. Ceramic affinities are to Kayenta, Chaco and northern Mogollon. Small pithouses, very different from other periods, sometimes are found near pueblos.

Nearby, Wasley (1960: 37-40) excavated Pueblo II components of five sites near Lupton assigned to the Red Mesa and Wingate phases on the basis of pottery and architectural remains. With one exception, components ranged from two to nine surface rooms. The architecture was varied, as was that of the associated kivas. They exhibited typical pueblo-kiva-trash mound village plan layout. Arizona K:12:10 was an anomaly, with domestic structures being pithouses used both for living and for storage. Two kivas, one circular and the other rectangular, showed a variety of interior features.

In the Hopi Buttes area Gumerman (1968: 189-191) distinguishes a definite difference in early Pueblo II sites and later Pueblo II sites (Holbrook phase), which began at about AD 1075. This is a slight modification of Colton's (1939: 67) Winslow branch of the Anasazi, defined on the basis of Little Colorado whitewares and architecture. In the light of previous discussions concerning both typology and Chaco-Little Colorado influences, what the meaning of this branch may be is unknown. Gumerman feels the break signals a change in influence from Kayenta to the Winslow branch in the Hopi Buttes region. He records five sites from early PII, none of which was excavated.

With the advent of the Holbrook phase in the Hopi Buttes area the number of sites increases to 41. This indicates an increase in population, but it is not known whether the increase is related to indigenous population explosion or to an influx of population from other areas. Sites from this period are located along low ridges or on the edges of bluffs or arroyos. They are evenly distributed and exhibit no clustering. Gumerman suggests that the settlement pattern is most economical for people engaged in floodwater farming in arroyo mouths and dune depressions. Individual sites are small, consisting of a pithouse and three or four surface storage rooms. Portions of three excavated multicomponent sites--Finger Rock, Kol and Ramp--evinced Holbrook occupation.

In the Hay Hollow Valley to the south about 150 habitation sites were recorded (Plog 1974: 30-40). There was a tendency toward centralization, with a valley-wide pattern of large sites surrounded by smaller ones that were surrounded by field houses. Five sites, which varied considerably in size, have been excavated. Studies have shown that several matrilocal groups existed within one of them, the Carter Ranch Pueblo (Longacre 1964; Martin _et al_ 1964). Both kivas and great kivas existed.

In summary, there is wide variation in known or suggested settlement pattern for the entire area surrounding the park. There is, as well, a great deal of variation in influences, or artifact and architectural style exchanges, between various subareas. The meaning of these influences is virtually unknown, although there are many suggestions. The lack of absolute dates and other quantifiable data, especially in the park, makes comparison difficult and it is possible that a longer time span than indicated at the beginning of this section may be involved when all sites are considered. Agriculture is definitely now considered the primary subsistence source, but very few studies checked for gathered resources. However, several trends are suggested. Reed (1947), Gumerman and Skinner (1968), and Gumerman and Olson (1968) all suggest a break in the middle of Pueblo II. The early part of this period really seems to be a continuation and perhaps an extension of the settlement pattern and lifestyle followed in PI and, possibly, BMIII. During this time there is a great deal more variation from site to site and from area to area. Rigidly patterned or highly stylized sites do not yet exist and groups seem to be more loosely organized. During the later half of the period obvious group cohesion exists, many site patterns are stylized and are relatively similar from area to area. They frequently appear to have been preplanned. Group ceremonial structures (great kivas and dance courts) appear. But other site types do occur. The reported settlement pattern in the Hay Hollow Valley (Plog 1974), with large sites surrounded by small sites in turn surrounded by field houses, would be very interesting to check on a valley-wide survey along the Puerco River. Gumerman and Skinner reported a population increase and it is possible that this could have occurred in other areas. A variety of factors that might begin to explain or even confirm these trends should be considered in future research in the park. They include possible environmental change, particularly that related to effective moisture, drainage patterns and growing season; the strong influence of the Chaco area and the possibility of well developed trade routes along the Puerco and beyond; and a more tightly knit development of social structure, whether it occurs from inside or outside the group.

Pueblo III (circa AD 1000 or 1100 to 1275 or 1300). This period is characterized by large multistoried dwellings, much increase in areal specialization and greater refinement of artifacts (Willey 1966: 208; Jennings 1968: 274-276). The famous multistoried "apartment houses" or villages, such as Pueblo Bonito in the Chaco region, Kiet Siel and Betatakin in the Kayenta region and Cliff Palace in the Mesa Verde region, provide the most spectacular examples. Toward the end of the period there was a marked decline in population. This was a general Southwestern trend and was not confined to the Anasazi region. Suggested explanations include drought, enemy warfare, a change in rainfall patterns from winter to summer rains, trade and population pressures. Most archeologists today feel that a combination of several of these factors was responsible.

In the park, Reed (1947: 16-17) divides Early and Late Pueblo III on the basis of pottery horizons. Forty-seven sites are considered early (Holbrook Horizon) and 23 are late (Walnut Horizon). Both single and multiple component sites are included. Reed (1947: 23) notes that the Walnut Horizon in the park area differs from a similar one defined by Colton only in the use of brown corrugated utility pottery rather than of Little Colorado Corrugated. Gumerman (1967: 16-18; 1968: 191-192) has found probable functional differences, as well as temporal differences, between the two pottery types used by Reed and Colton as horizon markers. The meaning of all this in the context of the park's archeology is not clear. Once again, a classification based solely on pottery analysis requires explanation with further hard data relating to all aspects of sites.

Agate House, reported by Cosgrove (1934) for purposes of ruin stabilization (see Appendix I), is the only excavated Pueblo III site within the park. It was excavated so long before much of the other regional work was done that very few comparisons could then be made. It is an eight-room pueblo, now reconstructed, situated on a knoll about 50 ft above the surrounding countryside. It was constructed entirely of petrified wood. Hough (1903) notes a similar structure among a group of ruins on the Scorse Range north of the park and several other pueblos constructed of petrified wood were noted by Reed's survey team. Agate House probably was occupied for only a short time. No exterior kivas were discovered, although Room 7 is much larger than the others and very unusual. It may have been used, if not as a kiva, for a lineage or clan ceremonial room, as is found on the Zuni reservation and among prehistoric Mogollon to the south.

Harrill (1972) excavated a small Mogollon campsite just west of Jim Camp Wash in the southern part of the park. The site has few clearly definable features and was intermittently occupied between AD 1150 and 1300. He suggests its use as an agricultural field house. This matches well with the settlement patterns discussed below in relation to his later excavation of the Dobell Site.

Within a mile of the western boundary of the park Hough (1903) recorded a group of Pueblo III ruins at the edge of a plateau that overlooks the Puerco River Valley to the north. There are at least two "great houses," large multiroom pueblos situated around a central courtyard. Their location so near the park boundary may account for the obvious lack of this site type within the park.

One mile south of the park on the Puerco Ridge, Harrill (1973) excavated the Dobell Site, a small pithouse village with a single component occupation between AD 1150 and 1250. There are affinities in the archeological assemblage to the Winslow branch of the Anasazi and to the Mogollon. The architecture is similar to that of the McDonald phase discussed below. Ceramics are nearly identical to those from Broken K Pueblo and Carter Ranch. Subsistence methods included agriculture, with a heavy reliance on hunting. Harrill informally surveyed a one-mile radius of the village and found seven more small villages in similar topographic settings. The settlement pattern is exactly the opposite of the established towns discussed by Longacre (1964) for the area 20 miles south. Harrill suggests several alternative hypotheses: sudden use of a heretofore unused area, owing to optimal climatic conditions; differential use of ecological zones, especially where the use of agriculture is marginal, and unknown pressures from outside the area causing a population influx.

The Whitewater district contains the remains of two early Pueblo III "great houses." Neither was excavated, but Roberts

(1939: 244-253) mapped the units. Both appear to have been planned. The northernmost unit had an earlier occupation and is attached to a great kiva by a courtyard wall built later than both structures. Within the courtyard is a kiva of larger than usual size, but smaller than a great kiva. Interior rooms in both stone pueblos contain circular adobe kivas, which Roberts believed to be clan houses. In front of the courtyard are two smaller structures that appear to have been towers. Both units show evidence of terraced architecture of up to four stories. Roberts again saw a clear association with Chaco and, on the basis of observed stratigraphy revealed by an arroyo cutting through a deep trash mound, considered the site to be roughly contemporaneous with the Village of the Great Kivas, near AD 1015 to 1030.

In the Hopi Buttes area the McDonald phase, which spans the interval between AD 1100 and 1200, also can be divided into early and late periods (Gumerman 1969: 191-195). There are 60 sites recorded for the early period and 81 for the late, demonstrating an increase in population. Individual sites are larger. There is no large site concentration and settlements cover most of the region, as they did in the preceding phase. Sites usually consist of four or five pithouses, several surface dwellings and an occasional kiva.

Two McDonald phase sites were excavated in the Hopi Buttes area and three at Holbrook. Pithouses continue to be favored dwellings, with side-by-side use of both Anasazi and Mogollon pithouse forms. There also are surface dwellings with five contiguous rooms, the maximum size achieved. Surface dwellings are variable in form and construction, with walls frequently constructed of adobe, even when tabular sandstone was available.

Two sites excavated by Gumerman, the Plaza Site in the Hopi Buttes area and the Sundown Site near Holbrook, are different from the others and show obvious ceremonial significance. They are larger and better constructed. They have a plaza orientation, a high ratio of ceremonial rooms to habitation rooms, and ceremonial rooms both within and outside of the room blocks. Each also has a great kiva. At the Plaza Site the great kiva is rectangular. Gumerman (1968: 194-195) hypothesizes that these ceremonial sites functioned as regional centers for group cohesion among a scattered population. He also suggests that the sites may have functioned as economic redistribution centers.

In the park, it is possible that the previously described Site 236, with its dance court, fits this category. However, neither its chronological position nor its use can be determined without excavation.

A few unequivocally defensive sites were recorded in the Hopi Buttes region, including several near Castle Butte and one high on Chisenchotha Butte, which was partially excavated (Gumerman 1968: 195; 1969: 179-192). The site is situated about 800 ft above the surrounding plain and is difficult to place architecturally and chronologically. Sherds indicate short or intermittent occupations during the McDonald phase and at some time during Pueblo IV. It is very large in relation to other sites of the period, with 15 rooms and defensive walls. Construction is of stacked basalt boulders. There are agricultural terraces and indications that agriculture may have been practiced elsewhere within the site. The sites are unusual for the area and Gumerman feels that these defensive sites and the warfare implied may, after all, have been a factor in the depopulation of the area at the end of Pueblo III.

Along Leroux Wash, Pilles and Hartman in 1973 salvaged a PIII site that showed signs of violence (P. Pilles 1978: personal communication). In a pit associated with a 15+ room pueblo and a great kiva they found the remains of 25 to 30 people. The number of people, ages and sexes were about what one would estimate the population of the pueblo to be at any one time. Five skulls, each with evidence of scalping, were found. Although some hands and feet were found, dominant bone types were long bones and skull fragments. Vertebrae and pelvises were missing. Long bones were uniformly broken into 10 cm to 12 cm pieces. The ends, but not the middle, of some long bone pieces were charred. Pilles and Hartman feel that cannibalism may have occurred at this site, although other explanations might be proposed. Whatever the case, violence did occur and the entire population of the pueblo may have been destroyed.

In the Upper Puerco region, Gumerman and Olson (1968) distinguish two phases--Houck and Kintiel--during this period. Numbers of Houck phase sites recorded or excavated were not discussed. The phase covers the last 20 years or so of the 11th century through the middle 1200s. It is characterized by the addition of polychrome pottery of the St. John's type cluster (Upper Little Colorado or White Mountain Mogollon regions) and by several architectural variations. The number of rooms per pueblo increases considerably to an average of 20 or 25 rooms. The number of kivas per site increases and only once was a kiva set within a room block found, unlike the Whitewater sites. Small rectangular pithouses are found, sometimes attached to the pueblos. Domestic and storage rooms frequently are paired. Evidence of burning, abandonment, rebuilding and trash accumulation all show that the sites were not occupied at the same time. The authors consider one site to be definitely Chacoan, with good evidence for a Chacoan migration during the Bonito phase. Because of this, as well as the artifact configurations, they suggest that the upper Puerco River was used as a trade route by Chacoan peoples and that the site could have been a trading outpost.

No sites of the Kintiel phase were excavated, nor have any sites from this phase been excavated within the wider region. The authors do not discuss the number of sites recorded. They consider it the terminal phase of occupation in the Upper Puerco region and feel that it lasts from about AD 1225 to the late 1200s or early 1300s. No pottery relationships to the Hopi, Zuni or White Mountain areas exist, placing these sites slighly earlier in time than the Puerco Ruin. The number of sites decreased and site size increased. Site pattern is that of a central pueblo with outliers. Most kivas are located in room blocks, great kivas occur, and "dance plazas" are found.

In summary, Pueblo III within the wider region was a time of great change, displaying trends toward more centralization and population aggregation in some areas, with a dispersed small village pattern in others. Religion or ceremonialism seems to have been approaching the Western Pueblo pattern and to have been complex. Several researchers have suggested that a food redistribution system accompanied that pattern. In several areas there is evidence of violence and/or warfare. All researchers distinguish two, and sometimes three, phases. Few sites have been excavated and most are incompletely reported. As elsewhere in the Greater Southwest, this seems to have been a period of extreme stress and is poorly understood.

Pueblo IV (circa AD 1300 to 1450). By far the most important occurrence during this period was the abandonment of vast areas and the aggregation of population in a very few areas. Site settlement pattern changed almost completely from the standard storage-dwelling-midden axis to large enclosed rectangular or oval settlements facing onto plazas. The Pueblo IV towns were even larger than those of Pueblo III (Willey 1966; Jennings 1968; Reed 1964).

During early Pueblo IV, pueblo dwellers were known only in the following areas of the Southwest (Reed 1964: 187-188):

> (1) the Rio Grande area, where a very scanty early occupation suddenly became tremendously expanded in the 13th century; (2) the Acoma district; (3) the Zuni country, as far east as the Ramah area, with numerous large 14th-century pueblos; (4) a few sites in the Petrified Forest; (5) the Hopi villages, with a mixture of elements from several directions; (6) the Verde Valley. . .and the Tonto Basin; (7) the White Mountains--Upper Salt drainage, many large sites from Pinedale and Showlow to Point of Pines; (8) southeastern Arizona; (9) the classic Casas Grandes culture or the Ramos phase of northwestern Chihuahua. . .; and (10) the so-called "Classic" stage of the Hohokam area. . .

Unlike much of the Southwest, therefore, Petrified Forest still had a significant population in early Pueblo IV. At this time people within the park and those from regional sites can be viewed as fully Western Pueblo. There remains, however, one typological problem that actually relates as much to the outdated techniques used early in archeology by Fewkes and others as it does to the remains themselves. The problem is the designation of a Pueblo IV regional variant of the Winslow branch by Colton (1939) on the basis of ruins excavated by Fewkes along the Little Colorado River. He divides Pueblo IV into two foci (phases): Tuwiuca (AD 1200-1300) and Homolovi (AD 1300-1400). Included in his scheme are the sites of Chevlon, Homolovi and Cottonwood, which are located between Holbrook and a point slightly west of Winslow. Not included are the sites in and near Petrified Forest, which were just being described at the time and were never fully published. Questions concerning the validity of these phases and the relationships between all the sites must be resolved after future work.

Petrified Forest contains five Pueblo IV sites, including the large Puerco Ruin. Another large PIV ruin, Wallace Tank (Stone Axe), is situated less than a mile east of the park boundary. Reed (1940: 18) identified all six sites on the basis of pottery typology as being equivalent to Colton's Homolovi focus. The Puerco Ruin and three smaller sites are more similar to each other than to Wallace Tank and one small ruin, which, in turn, are more alike. However, additional excavation at the Puerco Ruin has since revealed a probable occupation of AD 1250-1350 and one at Wallace Tank of AD 1300-1450 (Schroeder 1960: 13-14), with about a 50-year overlap in occupation.

Two sites within the park, No. 161 and the Puerco Ruin, have been excavated (see Appendix I). Site 161 was excavated in 1941 as an emergency salvage project by Bennet T. Gale, a park naturalist, under the supervision of Eric Reed. It is a small cave about two-thirds of the way up a sandstone escarpment about 1¼ miles south-southeast of the Puerco Ruin. There was nothing inside to indicate anything beyond the fact that someone had been there during Pueblo IV.

The Puerco Ruin is the only major Pueblo IV Western Pueblo ruin managed by the National Park Service. It is a compound pueblo apparently built all at once in a rectangular shape around a plaza. It has been estimated at 125 rooms. It stood one story high, with a double row of rooms and no exterior doors. Three rectangular kivas within the plaza and 30 rooms have been studied.

The ruin has been excavated four times (see Appendix I): by Hough (1903), Cosgrove (1934), Schroeder (1960) and Jennings (1967). No principal investigator has as yet fully reported his work.

Pottery associations are with Homolovi, Wallace Tank (Stone Axe), Hopi and Zuni. The compound is slightly later than Homolovi and was occupied about 50 years before Wallace Tank. Schroeder (1960) feels that people left this ruin a few at a time and joined others at Wallace Tank, which appears to have grown by accretion rather than plan. Schroeder discovered, but did not excavate, earlier remains under the northwest corner of Puerco Ruin, and Hough, Cosgrove and Schroeder all excavated earlier sherds from within the plaza. C. Jennings (1967) also mentions the same earlier remains, but he has not yet fully reported them. It is unknown exactly how long the site was occupied.

Rooms are grouped by interior doors in twos or threes, creating spaces presumed by Schroeder to be for the use of family groups. Rooms within the groups are functionally differentiated.

Wallace Tank was partially excavated and mapped by Hough (1903: 320-325). It is larger than the Puerco Ruin and is situated on an open plain. When Hough mapped the site it consisted of a plaza, at least four separated mounds of room blocks, outliers and three separate cemeteries. Much of the cemetery area and apparently some of the room blocks were destroyed in the process of building a large permanent cattle tank to make use of the springs there. The remaining cemetery sections are being systematically bulldozed and potted.

Hough excavated only in the cemeteries to recover gravegoods. He collected large amounts of pottery and other artifacts, including textiles. Pottery is similar to that from the Puerco Ruin and Homolovi, with the addition of many Zuni glazes. Haury (1941 letter on file at Petrified Forest National Park and the Western Archeological Center) wrote of this site: "I know of no other ruin so far west which shows the abundance of Zuni influence."

The Homolovi group near Winslow consists of four ruins in separate topographic situations on both sides of the Little Colorado River. Homolovi I (primarily the burial grounds) was tested by Fewkes and one kiva was excavated by Pond (1966). The kiva is interesting in that is has wall murals like those of Awatovi and Kawa'a much further north and east. The site is very large, consisting of two plazas surrounded by two-storied room blocks and ceremonial structures. Gumerman (1968: 196) reports that pottery from this site is almost indistinguishable from that of Awatovi, a large ruin on the Hopi reservation.

Chevlon, also excavated by Fewkes (1904), is east of Winslow on the south bank of the Little Colorado River at the mouth of Chevlon Creek. It is largely unreported. Fewkes excavated the burial grounds; burials resembled those at Homolovi almost exactly.

Unfortunately, none of these sites has been fully reported or studied. Just as in the rest of the Southwest, exactly what happened is not clear. On the basis of present information it looks as if residents of all mentioned contemporary sites maintained close contacts with each other, as well as with the Hopi and Zuni areas. The population continued to contract, moving from Chevlon, Homolovi, Puerco and Wallace Tank finally either to Hopi or to Zuni. It is not unlikely that with each abandonment of a pueblo some of the residents moved to the Hopi or Zuni areas. By about AD 1450 the prehistoric population had abandoned Petrified Forest.

As noted, causes of this contraction of population are poorly understood. In this region answers cannot possibly be derived without further archeological and environmental studies, both in Petrified Forest and in the Hopi and Zuni areas.

Navajo (circa 1550 to present). One Navajo site (4725A), located adjacent to the Flattop Site on a spur from the mesa top was recorded by the List of Classified Structures team. On the basis of architecture, the site dates to about AD 1750. It consists of a single sandstone slab structure shaped like an elongated circle with a very long and narrow entryway. It is accompanied by a possible cist, a stone alignment possibly used as a water control device and a number of bedrock mortars. Without further survey the site simply documents the fact that there has been Navajo occupation of the park.

Summary of the Status of Archeology in the Park

During the last 45 years more than 330 sites, ranging from the Archaic through Pueblo IV periods, have been recorded in the park (see Fig. 6). Six sites--Flattop, Twin Buttes, Agate House, Puerco Ruin, No. 171 and NA 10,808--have been excavated. Five prehistoric sites--Flattop, Twin Buttes, Agate House, Puerco Ruin and a petroglyph district--are listed on the National Register of Historic Places. A tentative breakdown of numbers of sites per period, based on observations and classifications of all researchers (see Appendix II for the most complete classification), includes:

Archaic	3
BM II	24
BMIII, PI	49
PI-PII	10
PII	169
Early PIII	47
Late PIII	23

PIV 5

All other sites have no chronological identification.

Sites in Petrified Forest do not correspond exactly to the periods specified for the Pecos Classification, and a regional sequence needs to be developed for the park. There is only one absolute date from the Puerco Ruin (Calvin Jennings 1978: personal communication); all other sites are dated by pottery comparisons. The following is a brief, general and informal description of the periods within the park. Anomalies and comparisons are discussed above.

Archaic. Recording of sites that may fit this period began only in 1976. The three known sites are on the same ridge extension from one of the Flattop mesas. They consist of lithic scatters with concentrations of sandstone slabs, hearths and small secondary flakes.

Basketmaker II (perhaps AD 300 to 500). Site types range from single pithouses to pithouse villages of up to 25 units. These are small, shallow, circular slab-lined pithouses with variable interior features, including wing walls. There are no formal interior hearths, but exterior slab-lined hearths exist. Most sites are located on high bluffs or mesa tops, but valley floor sites are known. Adamana Brown, a distinctive pottery, is found on all known sites. The Flattop Site has been partially excavated.

Basketmaker III (perhaps AD 500 to 700 or 800). Site types include small and large villages with pithouses, storage rooms and trash areas arranged in a crescent. Deep pithouse-protokivas are found, as are agricultural rock alignments. Sites are situated lower than are those of the previous period, but still are above the lowest valley floor and under the protection of bluffs. A variety of brownwares, graywares and black-on-white wares are reported (see Appendix II). One site, Twin Buttes, has been partially excavated.

Pueblo I (perhaps AD 700 or 800 to 850 or 950). No "pure" PI sites are known. It is thought that an occupational break or settlement pattern change occured in the middle of the period usually called PI. Reed (1947) actually classified no sites as BMIII or PI, but simply named pottery horizon styles before PII. N. Hammack (1978) classifies her sites, which may fall after this break, as PI-PII. Based on the excavation of the Twin Buttes Site and bearing in mind the recording difficulty, it is likely that a continuous occupation from late Basketmaker II through middle PI occurred in at least some sites, followed by a change to locations near drainages of site types usually considered early Pueblo II. There are no excavated sites, other than a part of the Twin Buttes Site. In nearby regions PI sites have been located in upland areas and it may be that PI sites are located in topographic areas within the park that were not thoroughly searched.

Pueblo II (about AD 900 or 950 to about 1050 or 1100). No sites from this period have been excavated in the park. Hammack notes that PI-PII sites are located more often on the valley floor and closer to drainages than are those of the previous period. They are very small pueblos with possible associated pithouses. Typical settlements for this period in other areas are similar, with masonry pithouses and pueblo-like surface structures. Pottery includes a variety of graywares, brownwares and black-on-white design styles (see Appendix II).

Pueblo III (about AD 1050 or 1100 to about 1250 or 1300). Two sites of this period, Agate House and NA 10,808, have been excavated. On the basis of pottery analysis, Reed divides this period into Early PIII and Late PIII. Two types of settlement pattern are known from within or adjacent to the park. Typically, both small and large pueblos with kivas and/or great kivas are found. Along with graywares, brownwares and black-on-white wares, polychrome pottery is found in these sites (see Appendix II). The period generally is characterized by contraction of the population, but this may not be the case for the park. A PIII occupation exists below a portion of the Puerco Ruin. Site 236, with its dance court, may be a PIII site.

Pueblo IV (about AD 1250 or 1300 to about 1400 or 1450). Two sites, the Puerco Ruin and Site 171, have been excavated. The Puerco Ruin is a large pueblo of about 125 rooms, with an interior courtyard and at least three kivas. All other sites probably are smaller, since descriptions of them have not crept into the literature and no site maps exist for them. This was a period of contraction of the entire population of the Southwest into a very few areas, one of which is the park. The population is fully Western Pueblo, and there probably was direct contact with Homolovi, Hopi and Zuni pueblos. The artifact inventory is complex and pottery is frequently indistinguishable from that found at the pueblos mentioned above (see Appendices I and II).

It is apparent from the above description that information is spotty and frequently lacking. No chart for site comparison has been prepared for this report because much of the data simply does not exist. Only three types of presently usable information were recorded on surveys prior to 1975: (1) very accurate site location, (2) pottery description and identification and (3) the existence of architecture. Broad descriptive categories not included in survey information prior to this time are:

(1) All aspects of settlement pattern--no site maps, site situations, recording of features and artifact clusters, architectural descriptions and measurements;

(2) All aspects of modern environment--plant cover, soil type, topography, hydrology, location in relation to minerals, water, agricultural fields;

(3) Description of artifacts other than pottery--type and material of chipped lithics and ground stone, existence and type of bone, shell, wood, minerals;

(4) Recording of sites that do not contain visible architecture--lithic scatters, petroglyphs, agricultural alignments, rock shelters, burials, corrals, lean-tos, bedrock mortars (all of which I have observed);

(5) Recording of Navajo sites--the List of Classified Structures team recorded one Navajo site in 1976. Some petroglyphs and probably the corrals are Navajo. The park is adjacent to the Navajo Reservation and it is expected that future surveys will record more sites.

Condition of sites in the park is, on the whole, amazingly good. Visitors are not allowed outside specified areas and much of the northern part has been designated wilderness. Early construction projects have damaged some areas. Much of the area in or adjacent to the headquarters section was bulldozed when the new buildings were constructed many years ago. Construction of a water pipeline at about the same time ripped through the middle of several sites I have seen. Lands adjacent to visitor attractions and highways are the most subject to human impact. Natural erosion of the valley floor and, particularly, of the cliffs at the edge of the Painted Desert and other badlands areas is destroying an unknown number of sites, which are falling down the cliffs. However, sites in general are well preserved, well protected and undisturbed by humans.

Chapter 4

Recommendations

The clearest and most important future research need is that for quantitative data discussed in preceding chapters. This information can be applied to a wide variety of common or standard archeological research questions. Scattered throughout the text are a variety of hypotheses and unanswered questions. In order to answer them and to thoroughly understand what happened in the prehistory of the park, there are five major categories to which much future research should be directed. These are: (1) establishing an absolute chronology and phase system, (2) determining the environmental history, (3) determining the effective environment during each phase of settlement, (4) determining the settlement pattern and its changes through time and (5) determining the relationships to other sociocultural groups.

In addition to the general problems listed above, there are special archeological study areas or problem categories within the park that warrant further discussion. They are petroglyphs, ethnic boundary areas and trade.

Petroglyphs. The park is famous for its petroglyphs, some of which decorate this report. They occur both in groups, which can extend over as much as a half-mile by 50 to 100 ft high, or separately and isolated on sandstone outcrops or rockfalls. They do not occur on all outcrops. There are a variety of styles, including those used in weaving and pottery designs. These petroglyphs have never been recorded.

Until recently, petroglyphs were studied primarily as an art form, which is a valid study. Viewing them has always raised numbers of questions for archeologists and most other people.

They must reflect some aspects of the societies that produced them, but which aspects? Are they merely art forms, directional signals, clan symbols, religious images, aids to magic, or combinations of these and more? What groups of figures belong with particular periods and/or cultural groups, and why? Do some types of societies produce more petroglyphs than others, and why? Do some types of societies produce more of certain kinds of petroglyphs than others, and why? Are petroglyphs, along with other art forms, an indication of some kind of societal floresence?

Heizer and Baumhoff (1962) conducted perhaps the most successful archeological studies in rock art. By correlating rock art locations, locations of archeological sites and functions of these sites, they found that 90 percent of the petroglyph sites in the Nevada-California desert were related to the hunting of large game. The petroglyphs occur in close proximity to springs or at ambush spots along animal migration routes. After isolating seven rock art styles and tentatively dating them, they concluded that these petroglyphs were not sign language, but probably were produced as part of shamanistic ceremonies, magic rites performed in aid of the hunt.

In the Navajo Reservoir district of New Mexico, Schaafsma (1963) isolated several rock art styles, particularly of the human figure, and correlated some styles to Basketmaker II and some to Navajo. Puebloan styles are more tentatively correlated. Unfortunately, pottery decorative styles, which would have led to easier time correlations, were not reproduced in petroglyphs. She suggests attempting correlations between petroglyph sites and styles and nearby archeological sites and styles in future studies.

Pilles (n.d.) has begun to make such studies of petroglyph sites near the Little Colorado between Holbrook and Winslow. He has succeeded in describing seven styles, which include a variety of techniques, ranging from Basketmaker I through modern. He was able to tentatively correlate times because of superposition and comparison with pottery and other decorative styles. Unfortunately, the region is not thoroughly surveyed and correlations between sites are difficult to make. His study makes a good beginning for that in the park.

Petroglyphs within the park exhibit a variety of techniques and styles. They should be carefully recorded, perhaps with modern photographic techniques, and styles, where possible, should be discerned on the basis of technique, form and comparison with pottery, weaving, basketry and kiva murals. Correlations between the discovered styles, their locations and the locations of sites from the same period should be attempted. Correlations between modern pueblo clan symbol petroglyphs and their locations also should be attempted. Attempts at ethnographic analogies with the uses of modern Hopi and Zuni ceremonialism, including sandpainting, should be made.

Ethnic Boundary Areas, Frontier Areas, the Brownware-Grayware Boundary. Virtually all archeologists who have worked in Petrified Forest, as well as along a wide east-west line running approximately from Winslow, Arizona, to central New Mexico, have commented upon and documented the intermixing of Anasazi, Mogollon and, to a lesser degree, Sinagua characteristics, along with those of subtraditions or regional manifestations within each particular group. Few archeologists have proceeded beyond general description and comment. Notable exceptions are Dittert (1959) and Ruppe (1952), who developed trait-intrusive and site-intrusive characteristics while doing research on Acoma Pueblo. Usually, however, interpretations such as migration, two groups living side-by-side and peaceful intermingling of groups are offered. All probably are true at one time or another.

Archeological evidence of this intermingling has most frequently been described in relation to pottery design style and manufacture and variation in architectural style. These manifestations occur in a number of different ways in excavated sites:

(1) As entire communities from an adjacent or nearby territory with architecture, pottery and site configuration unlike those in the territory in which the community is located;

(2) As communities that contain several architectural units in styles from various adjacent territories. Within each unit the pottery and some other artifacts are exactly those that one would expect to find in the territory in which the architectural style is found;

(3) As communities in which architectural units exhibit a mixing of styles from several territories and the pottery is from only one territory;

(4) Most frequently there is extreme variability. Architectural units (particularly habitation units) exhibit a wide range of variation that includes separate parts from several adjacent regions or subtraditions. Pottery styles include those from many territories. Percentage of pottery types will vary from site to site, with one or the other territory predominating. Pottery styles may have paste, temper and form from one territory and painted design style from one or more other territories.

There probably are many other, less easily detected manifestations of this phenomenon, such as differences or similarities in functional use of particular types of pottery between sites and differences and similarities in intrasite settlement patterns.

It should be possible to more fully understand this phenomenon in terms other than simple proxemics or migration. However, both must have played a part. In particular, small scale migration is increasingly being discussed by modern archeologists as a response to a variety of societal and environmental pressures, just as was predicted by early Southwestern archeologists. The important questions here are: Why does this happen? What are the mechanisms operating to produce this phenomenon or under what conditions does this mixing occur? Are the mechanisms or conditions always the same or are there a variety of conditions at work? Do they vary through time and space? Do the various sorts of recorded archeological manifestations indicate several types of social, political, economic and environmental mechanisms, such as alliance through intermarriage, widespread ceremonial or political integration, trade, short term environmental change in adjacent areas, population explosion in adjacent areaa, or particularly favorable environmental conditions in the area being studied?

These questions are related directly to anthropological problems and theory currently being examined by ethnohistorical archeologists and cultural anthropologists. Comparative research between current ethnological studies of ethnic boundary areas, ethnohistoric (sometimes called ethnoarcheological) studies of known incidents of cultural mixing or splitting among the Western Pueblos, and prehistoric archeological studies to provide time depth (and, perhaps, a greater variety of situations) may very well produce some usable answers.

Ethnologists working primarily in Asia and Africa have in the last few years begun to document areas that have no ethnic boundaries. Like those in archeology, these areas had not previously been selected for study, primarily because of cultural and theoretical bias among investigators. In an overview of problems related to ethnographic studies of these areas Levine and Campbell (1972) found that a bounded social group (one in which perceived social units maintain territorial boundaries of breeding, language, economics, sociopolitical structure and culture) generally is more efficient than is an unbounded group. Bounded groups, however, more frequently are found under conditions approaching statehood or where statehood has been achieved, that is, in association with an advanced state of political development and a relatively high degree of stability. Levine and Campbell suggest that unbounded groups exist under two conditions: (1) that in which environmental pressures are not operating to produce boundedness (that is, when flexibility in boundaries is helpful in maintaining survival), and (2) that in which a large empire, composed of many ethnic groups, collapses and is not replaced by stable political units. It is likely that other conditions also foster unboundedness.

Whatever the causes, the authors discuss five documented phenomena from ethnic boundary area studies that cast doubt on the absoluteness of sociocultural entities with firm boundaries:

(1) Territorial interpenetration of ethnic communities. This frequently occurs in the form of a mosaic. It can be associated with nomadism, small scale and large scale migrations, and conquests and expulsions of people;

(2) Continuous variation in cultural and linguistic characteristics. The existence of a particular artifact, marriage or inheritance practice, language or other social characteristic does not automatically stop when one moves from one adjacent group to another. A related phenomenon, that of noncongruent variation, frequently occurs here. If one were to map each different physical, social or other characteristic studied, each map would be different. It has been shown that language, long thought to define a particular group, maps in the same way as do other characteristics;

(3) Disagreement about ethnic boundaries and labels among the people themselves in the regions studied;

(4) Interaction across ethnic communities. Several major kinds of interaction include military alliance, interethnic joking relationships (interpersonal and intergroup), economic (including trade) and marriage;

(5) Shifts of ethnic identity and culturally defined lifestyle. This extremely surprising phenomenon can occur for strategic advantage (a sort of social climbing) or functional necessity

(such as that created with a complete change in subsistence pattern). Levine and Campbell feel this phenomenon probably is dictated by local circumstance, rather than being unidirectional for an entire region.

The Petrified Forest region superficially appears to fit many of these categories for unboundedness, and this should be studied by future archeologists. Mechanisms that could have operated to promote this condition include trade, migrations, environmental pressures and certain types of social organization. Methods for discovery of these categories, if they exist, as well as those for discovery of the mechanisms that operated to promote them, should be incorporated in the research design, particularly for excavation. These methods should include at least those discussed elsewhere for recovery of environmental, trade and social organization information. In addition, every effort should be made to discover small scale or family migration, which could include such evidence as houses within villages that contain artifacts, arrangements and accoutrements primarily characteristic of another group. Ethnological studies of ethnic boundary areas, both of individual groups and incidents and synthesis for overall interpretation, continue and should extend the possibilities for hypothesis formulation for archeologists.

Ethnohistorical and ethnoarcheological researchers attempt to solve anthropological problems by studying the archeology of living groups or of recently abandoned sites where incidents, pressures, responses and relationships already are known. Because direct ancestors of groups that lived both in the Petrified Forest and in nearby areas continue to live on the Hopi and Zuni reservations, studies of occupied or abandoned sites where known incidents of cultural mixing occurred should be valuable for comparative studies of ethnic boundary areas. Perhaps the most provocative case is the documented move of a Tewa group from New Mexico to Second Mesa on the Hopi reservation. At first, the Tewas lived apart in a village adjacent to the Hopi village, but assimilation--marital, religious and political--eventually occurred. Now, several generations later, individuals still are aware of their particular heritage and behave accordingly. The archeological record of this assimilation remains and offers a superb chance for this sort of study, as first suggested by Dozier (1970) and later by Stanislawsky (1969).

Archeologists researching prehistory in Petrified Forest and related areas will need to very carefully develop descriptive and analytic techniques to approach this problem. Methods for the discovery of trade, environmental and population pressures, small scale or family migration, certain types of social organization, and other pertinent categories discovered in ethnological and ethnohistorical studies should always be incorporated in excavation research designs. Provision should always be made for documenting the variation in types of blending evidenced in the archeological record. When possible, comparative studies between sites in the park and those in influential areas should be done.

Trade. Trade is discussed above as a possible mechanism for the promotion of cultural blending and an aid in the understanding of ethnic boundary areas. However, it is important in its own right as a means of tracing prehistoric networks, helping to ascertain some types of political or ceremonial organization, and determining the geographic extent of a group's exploitation or use. All archeologists working in the vicinity of the park have discussed the possibilities of trade in the region. There are several reasons for their speculations and they vary through time. The reasons, along with suggested methods for analysis in the park, are listed below.

(1) Documented natural resources that are unavailable in the park or immediately surrounding territory: These consist primarily of shell, coral, turquoise and obsidian, but many other mineral resources probably could be added to the list. Worked shell was excavated from the Flattop, Twin Buttes and Puerco sites. The

Twin Buttes Site, in particular, contained significant amounts of shell from both the Gulf of California and the California coast. Coral has been discovered eroding from unexcavated portions of the same site. Shell trade routes have long been studied in the Southwest, both generally and in relation to individual sites (Brand 1938, Tower 1945, Kean 1965, Haury 1976). The Petrified Forest region always is listed as being on a suspected major trade route. It is thought that routes tended to follow waterways and/or areas of least geographic resistance (Kean 1965). Turquoise has been recovered from the Puerco Ruin. Several prehistoric turquoise mining sites are known and turquoise recovered from archeological sites can now be chemically traced under certain conditions (Haury 1976; Colberg-Sigleo 1970, 1975, 1976). Obsidian was excavated from the Twin Buttes Site. Under certain conditions a limited area of origin and/or the exact quarry source can be traced (Stevenson *et al* 1971, Jackson 1971, Jack *et al* 1969).

(2) Profusion of pottery types and styles: The region is archeologically notorious for this reason, so that few archeologists today are well qualified to deal with this mixture. Not only is there a profusion of types recognized as being characteristic of other areas, but there also are unusual combinations. For instance, a vessel with the shape and similar colors and design style of a particular pottery type may have a different paste and temper. Any combination of the above characteristics may be found and graywares (i.e., Lino Gray) usually are whitewares. It is very important in sorting this confusing mixture to answer questions both of trade and of ethnic boundary areas to discern which pottery types were traded into the area, exactly where they came from, and which were made within the park.

Most archeologists working in or near the park have expressed opinions concerning trade pottery within the park. A few hypotheses are mentioned below as examples. Other discussions for various periods, series and influences may be found in Colton (1939), Gumerman (1969), Gumerman and Skinner (1968), Gumerman and Olson

(1967), Roberts (1939, 1940) and Ferg (1978). Reed (1940:23) states:

> It is believed that all, or virtually all, of the black-on-white wares (and, also after 1100, certain other varieties of pottery) were received by the people of Petrified Forest through trade. The local ceramic production seems to have been exclusively or primarily brownware, plain brown, red slipped, and smudged, developing into black-on-red and brown corrugated types .... and the people of Petrified Forest, or at least their pottery, would thus seem to be of Mogollon affiliation.

Wendorf (1953) advances the hypothesis that all brownware excavated from Basketmaker II and III series (accounting for over 40 percent of the pottery recovered) was obtained in trade and that graywares were indigenous. This includes the Adamana type and the Alma and Forestdale series. His conclusions were reached because Adamana is a well developed type, other brownwares usually were found in a burial context, the comparable Bear and Bluff sites had higher percentages of brownwares, and architecture was Anasazi-like. Schroeder (1961) states:

> The following pottery types appear to have been made locally: Homolovi Corrugated; Black Ax Plain; and Homolovi Red, Black-on-red, White-on-red, and Polychrome. The most common tradeware is Jeddito Black-on-yellow from the Hopi country. Zuni glazes (Pinnawa Glaze - Polychrome and Wallace Polychrome) are rare.... The presence of varieties of Gila Polychrome, but exhibiting local paste, again indicates the need for an intensive study of these varieties and their distribution in Arizona.... Among the pottery types listed on the chart are Homolovi Red and Homolovi White-on-red. These are new types which are the same as Homolovi Black-on-red and Homolovi Polychrome in all respects except for final decoration.

Colton (1939) and Gumerman (1969) both distinguish some type of cultural break between Holbrook and Winslow related to pottery; it is usually assumed that Little Colorado whitewares were made in the vicinity of Winslow, but they could also have been made in the Petrified Forest area.

In short, many archeologists have commented on this question, based on their prior knowledge of Southwestern ceramics, but few have quantified their statements. Shepard (in Wendorf 1953) conducted comparative studies of color, paste, temper and firing techniques on the pottery of the Flattop and Twin Buttes sites and that of the Bear and Bluff ruins. Several techniques were used, but they did not include examination of thin sections. She offers several useful hypotheses and notes specifically (1) that the graywares and brownwares could not have been produced from the same clay source and (2) that there are four classes of brown paste pottery in the park: micaceous, sand-, sherd-, and rock-tempered. The first three form a chronological sequence. Among her suggestions for future research is a search for clay and temper sources.

Schroeder (1961) has recorded a major source of rock temper, but in which or how many pottery types the source was used is unknown. The site consists of a sandstone outcrop in which the sandstone exhibits much variation in consolidation. Manos and metates from throughout the park apparently were made from the more densely consolidated parts; temper was obtained from the more loosely consolidated sections. A large area surrounding the outcrop, which rises in a 20-foot high lump from the surrounding bentonite, is densely littered with petrified wood hammerstones. No petrified wood occurs naturally nearby.

Within the park there are no identified clay sources or even known areas where clay suitable for pottery making might occur. As noted in Chapter 3, the bentonite found throughout the park is thought to be unsuitable for pottery manufacture because it shrinks and cracks too much in drying. Possible sources should be searched for and replication studies should be done. In addition, there is a new method for the technical study of clay resources for pottery types that, ideally, involves the location of clay sources, but which may be done on a comparative basis without known locations. The method uses comparative neutron activation analysis of powdered samples of sherds and suspected clay sources, as well as samples from several sites (Koerper et al 1978). The cited study found that the pottery in question was produced on-site from several nearby clay sources, rather than being traded in from far away as previously had been accepted for this pottery type. The study is significant for possible use in the park for several reasons: (a) The type studied was Tizon Brownware, a plainware that is difficult to study because it is widely scattered from western Arizona to the California coast and has a basically unconfirmed chronology. It generally has been assumed to be a tradeware from the Colorado River area. (b) Sherds from different sections of the studied site matched different clay sources, although sections also could be mixed. This could be important not only for trade studies, but also for those involving social organization or extended family relationships, particularly when they can be backed up by design style studies on other pottery types. (c) Even when clay sources cannot be located it can be shown whether or not sources were the same in several areas of one site or in several sites. In some cases one might not be able to prove trade or local manufacture, but only that different sources were used. But if one were to compare, for instance, Adamana sherds from the Bear Ruin and the Flattop Site and find a correspondence in clay source, trade would be confirmed. (d) It allows the comparative technical study of previously excavated and properly documented collections.

Other studies could help to provide adjunct proofs of trade. Both Wendorf (1953) and Gumerman (1969) discuss possible functional uses for pottery types. If future studies show the same uses in their known or suspected areas of origin, validity is increased. Whittlesey (1974) identified suspected trade ceramics through the functional analysis of such attributes as bowls shaped so that they could be nested for easier carrying.

(3) The geography: The park's location is advantageous for trade. The east-west river valley connections between the Colorado, Little Colorado, Puerco and Zuni rivers offer a convenient travel route. Sitgreaves (1853) chose this route in 1851 because

it offered him the easiest cross-country access to the mouth of the Colorado. As Gumerman and Sutton (1968) note, it is no accident that a major east-west railroad and highway artery exists there now. The archeological record (Hough 1903) attests the fact that a north-south route by way of Chavez Pass in the White Mountains also existed. Colton (1964) has documented Hopi trails known from the time Ives (1861) traversed the area. Since settlement of the park region had ceased about 400 years earlier, trails did not cross it. It should be possible, however, using Colton's map and other documentation of trails, to reconstruct various trade routes through time.

The park is situated on the edge of the Colorado Plateau and is very near the White Mountains, which have an environment very different from that of the plateau. Prehistoric groups frequently are adapted to particular environmental areas. When this is the case, trade between nearby groups in order to make use of items unavailable in a particular environment sometimes occurs.

(4) Procurement and dispersal of petrified wood: Wendorf (1953) suggests that petrified wood from Petrified Forest would make an excellent exchange material in trade, owing to its brilliant colors, variation and extreme workability. Mera (1934), Wendorf (1953), Jepson (1941) and Harrill (1971) all discuss lithic scatters that are denser and more extensive than associated sites seem to warrant. N. Hammack (1978) recorded several extensive quarry sites and noted a difference in the use of lithic materials through time. Jepson (1941) describes lithic quarry sites along the Puerco, but these are not specifically documented; very few finished tools in relation to lithic debris were found at excavated sites.

Many archeologists briefly discuss finds at many sites in the Southwest of petrified wood thought to be from Petrified Forest. However, it has not been possible to determine whether or not this stone actually came from the forest. Two recent aspects of geological research may allow future absolute locational documentation of petrified wood, both from previous and future excavations. Travena (1975: personal communication) believes that petrified wood of such bright colors, particularly greens and blues, exists nowhere in the Southwest but Petrified Forest. This should be scientifically documented. Anne Colberg-Sigleo, a geological chemist, at present is analyzing some aspects of petrified wood related to its formation. She feels it may be possible to chemically determine sources for petrified wood (1977: personal communication). This research, in combination with archeological library and laboratory research related to previous excavations and surveys, could produce a preliminary documentation of a petrified wood trade network if it existed. A mapping such as this, if compared with a mapping of sources of known trade items into the park, might produce preliminary documentation for more extensive trade networks, including possible routes.

In short, there is little serious documentation of suspected trade, whether it occurred on a casual or more formal basis.

A series of formal studies related to petrified wood procurement and distribution, comparative pottery manufacture and distribution, temper and clay resources, and location and distribution of known trade items, such as shell, coral and turquoise, may provide preliminary statements concerning Southwestern trade networks. At the very least, future documentation of artifacts, sites and contextual relationships should be extremely specific to allow for this type of study.

Recommendations for Resource Management

The following recommendations are based on the data, deficiencies and research questions discussed in this report. They are listed in descending order of importance.

1. Nominate all existing sites to the National Register of Historic Places. This is required for compliance with Executive Order 11593 and facilitates further compliance actions under 36 CFR 800 (Section 106) when they become necessary. Because sites

are scattered throughout the park, either a district nomination that follows the boundaries of the park or a multiple resource nomination in the same manner would be simplest to administer. Nomination in no way changes the procedures followed at the present time; it simply documents known sites and completes the first step of the federal compliance process. A Memorandum of Agreement with the State Historic Preservation Officer has been developed to accomodate most routine maintenance and repetitious occurrences.

2. Develop a research design. This should be used both for short term cultural resource management surveys and for longer term sample surveys. Excavation research designs should be developed that will eventually provide data to answer questions of concern. The design should be reviewed and revised at regular intervals and after major fieldwork occurs.

3. Intensive survey of all Headquarters areas and areas of high visitor impact. These are the areas in which most inadvertent site destruction occurs and in which most groundbreaking occurs. Location, mapping and judging the significance of these sites allows unhurried, considered decisions regarding protection, preservation or salvage. It also greatly facilitates management decisions concerning location of use areas, pipelines, and so forth.

4. Catalog artifacts located in the park. A number of collected or acquired archeological and ethnographic materials are stored at the park. Although they have previously been cataloged, some artifacts apparently no longer exist. Both cards and artifacts should be checked and updated within the existing National Park Service catalog system.

5. Sample survey of the entire park. This is the most important recommendation for determining the full range and character of the archeology of the park and acquiring the needed data base. Financial considerations preclude the 100 percent survey required by Executive Order 11593. Budget requests for a 10 percent sample survey already are on file. The sample may be predic-

tive when considered with the data from prior surveys.

This survey should be stratified at least on the basis of landform and plant cover. It should include both transects for the maximum discovery of variety in site type and location and quadrats for determination of settlement pattern. When stratification allows it, transect surveys should proceed adjacent to unsurveyed sections of the road, rather than randomly, since these also are high impact areas and need protection. Aside from recording all site types, other information, such as mineral deposits and locations of possible dry springs, should also be recorded. It will be especially important to note sites that are being seriously eroded away from edges of escarpments. Because of the cultural complexity of the park, artifact collection will be necessary.

6. Salvage of a sample of ruins being destroyed by natural erosion. This should not occur until the sample survey has been accomplished and the extent of the problem determined. If salvage is found to be necessary at the time, a sample only should be salvaged. Excavation should proceed on a priority basis, possibly through a series of tests only, to answer questions posed in the texts of this report and those resuting from the survey. Particularly, every effort should be made to recover absolute dates, environmental history and the range of variability in these sites.

7. Adjunct studies. These studies are necessary to answer questions of environmental history, trade, subsistence and mineral resources posited in this report. Some could be accomplished only in conjunction with excavation. Many could be accomplished as a part of scientific studies done in the park for reasons other than archeology. Providing directed Antiquities Act and other permits, along with grants, when possible, to doctoral candidates in appropriate major fields of study should considerably lower costs and increase the possibility of accomplishing these studies. It may also be possible to elicit the aid of such organizations as park and monument associations or such research support groups as the

National Science Foundation.

Recommended adjunct studies are:

a. Low level aerial photography for location of agricultural rock alignments. This should be done in conjunction with the archeological survey.

b. Soil and mineral survey to determine prehistoric agricultural possibilities, usable clay and temper sources, and the exact locations of available minerals, including lithic resources, for studies of settlement pattern and trade. The already available color and infrared aerial photographs and plant cover maps should be of considerable help in this research.

c. Hydrological studies, including (at least) determination of cut-fill sequences and location of ancient springs and ponds, for determination of environmental history and causative factors in settlement pattern.

d. Pollen sampling, both inside and outside archeological sites. This sampling is a necessary part of modern archeological excavation and is used for determining environmental history and prehistoric subsistence. Sampling away from sites also is necessary for comparative purposes. Obviously, a part of this research could only proceed when archeological excavation is underway. However, in some cases, datable environmental history studies can be done using dendrochronological studies of buried log deposits.

e. Chemical composition, structure, color and source studies for petrified wood to ascertain whether or not this lithic material can be absolutely identified as originating in the immediate area of the park. If so, existing collections from excavations of related sites in the Southwest should be examined for determination of trade relationships and routes.

f. Comparative pottery research, particularly of composition, replication, form and contextual association, for determing trade relationships and routes, pottery origins and, possibly, some aspects of social relationships. This, too, would involve use of collections of related sites from outside the park and should be performed in conjunction with clay and temper resource studies.

8. Acquisition of Site 236. This is recognized as an unusual recommendation. However, this site, while not unique, is one of a very few similar sites in the Southwestern United States. Most of the land adjacent to the park, including that on which the site is located, is being sold to the general public in 40-acre tracts. The site is in pristine condition, is adjacent (within this sort of tract) to the park boundary, and could be acquired for a reasonable amount of money.

Appendix I

PROJECT SUMMARIES

PROJECT TITLE: C.W.A. Archeological Survey, 1933-34.

PRINCIPAL INVESTIGATOR: H.P. Mera.

SPONSORING INSTITUTION: Civil Works Administration, in cooperation with the Laboratory of Anthropology, Santa Fe, New Mexico.

DATES OF FIELDWORK: No exact dates given. Mera was assigned to head the project in December 1933 and the report was published in June 1934.

LOCATION OF SURVEY: Included were (1) all lands within the boundaries of what was then Petrified Forest National Monument (145.75 mi^2); (2) most lands adjacent to the monument, except those on the Navajo Reservation to the north; (3) two separate parcels up to 30 miles away, one near Woodruff and one along Silver Creek.

PURPOSE OF PROJECT: The survey fulfilled the third aim of a three-part project: "(1) Excavation and partial restoration of a small pueblo ruin known as Agate House; (2) excavation of several rooms in the ruin lying just south of the Monument bridge over the Rio Puerco (Puerco Site), together with such measures as were necessary to keep their walls from further crumbling and also a test of the adjacent refuse deposits for stratigraphic evidence; (3) an archaeological surface survey of the entire Monument area upon which to base an estimate of conditions in the past and an outline of its prehistory" (Mera 1934: 1).

TECHNIQUES AND INTENSITY OF SURVEY: This would be designated a reconnaissance survey today. No specifics of strategy or techniques are discussed. Mera collected large pottery samples from each site surveyed.

SUMMARY OF RESULTS: Mera found 109 sites, 87 within the monument and 22 outside the monument. He felt that sites ranged from circa AD 500 to AD 1400. Chronologies are listed in terms of pottery types, several of which are defined for the first time in his report.

An apparently unbroken chronology extends from Basketmaker III through Pueblo IV, including architectural changes from pithouses to pueblos. Earliest Basketmaker III sites showed influence solely from the south. Beginning with middle Basketmaker III, however, and continuing until prehistoric occupation ceased, pottery showed equal influence from the north (Anasazi) and south (Mogollon), manifested in separate pottery types. Many types were aberrant, showing paste from one type being used in combination with painting designs from a different type. Interestingly, he felt that trade pottery did not appear until the larger pueblos came into existence. Lithic scatters were noted, but not recorded. There were no diagnostic artifacts to indicate whether they were pre-pottery scatters or associated with later sites.

There was a large discrepancy between the numbers of sites found in the northern and southern sections. The southern section had a much higher number of sites than were found in any of the surrounding regions. The largest numbers of sites were found to occur along the edges of escarpments that bounded badlands areas. Sites also occurred near geological formations that could have produced springs prehistorically, on flat-topped buttes and near heavily alluviated areas. Sites are categorized according to pottery type and, in two cases, architecture.

EVALUATION: A reconnaissance survey that collected and analyzed pottery for culture history chronologies was an acceptable and valuable contribution in 1934. With very few changes (cf. Reed 1955), Mera's conclusions concerning temporal placement and description of pottery types are valid today. Interestingly, his observations concerning the settlement pattern and culture history of the area appear also to be valid, but this must be substantiated. Mera's report did meet the stated purpose. Description and quantification would have provided information that would be useful today.

REPORTS:

Mera, H.P.

1934 Observations of the archaeology of Petrified Forest National Monument. Laboratory of Anthropology Technical Series, Bulletin 7.

PROJECT TITLE: Excavations of Agate House, Puerco Ruin, Flattop Site. C.W.A. Archeological Programs, 1933-34.

PRINCIPAL INVESTIGATOR: C.B. Cosgrove, Jr.

SPONSORING INSTITUTION: Civil Works Administration, in cooperation with the Laboratory of Anthropology, Santa Fe, New Mexico.

DATES OF FIELDWORK: No time stated; presumably the winter of 1933-34. One day was spent excavating two pithouses at the Flattop Site.

PURPOSE OF EXCAVATION: The excavations fulfilled the first and second aims of a three-part project headed by H.P. Mera (1934: 1): "(1) Excavation and partial restoration of a small pueblo ruin known as Agate House; (2) excavation of several rooms in the ruin lying just south of the Monument bridge over the Rio Puerco (Puerco Site), together with such measures as were necessary to keep their walls from further crumbling and also a test of the adjacent refuse deposits for stratigraphic evidence; (3) an archaeological surface survey of the entire Monument area upon which to base an estimate of conditions in the past and an outline of its prehistory."

EXCAVATION SUMMARY: Three sites were excavated and are summarzied separately below.

(1) AGATE HOUSE

LOCATION OF SITE: NW¼ of NE¼ of Section 12, Township 16 N, Range 23 E.

SITE DESCRIPTION: Agate House is an eight-room pueblo situated on a knoll about 50 ft above the surrounding countryside. Before excavation the surface of the knoll showed sheet distribution of lithic and pottery debris but no trash mounds. The pueblo was constructed entirely of agatized petrified wood sealed with adobe. Today it is a major tourist attraction because of its spectacular construction and colors.

STRATEGY OF EXCAVATION: No strategy was discussed, although a list of the order in which rooms were excavated is given.

SAMPLING PROCEDURES: The site was 100 percent excavated within the pueblo. Since a human jawbone was found beneath the surface outside the north wall, it is assumed that excavation extended outside the walls but this was not discussed.

EXCAVATION PROCEDURES AND TECHNIQUES: There is no mention of horizontal and vertical controls, recovery techniques, size of field crew, or the relationship of any of this to the purposes and results of the excavation. Techniques of stabilization are discussed in detail.

SUMMARY OF RESULTS: Rooms, with the exception of Room 3, which had an offset, were rectangular. They averaged 6 ft by 6 ft, except for Room 7, which had inside dimensions of 14 ft 6 in by 8 ft 6 in. Entrance was through the roof. Roof construction was of grass, sticks and mud. Walls averaged 1 ft thick and rarely extended much above floor level. Floors were poorly defined, uneven and had never been leveled; they were 8 to 18 in below the present ground surface. Fill consisted of fallen wall materials, along with windblown sand and a few sherds. Firepits were found in two rooms; ash and charcoal were scattered on the floors of other rooms. The rest of the rooms contained sherds or crushed pottery vessels, worked sandstone slabs of unknown function, and sandstone metates and/or manos.

The largest room (No. 7) contained most of the sherds excavated, as well as four crushed pottery vessels, bones of both mammals and birds, an adult human jawbone, bone tools, bead blanks, stone slabs, a slab bin, a metate, 16 manos (both utilized and unutilized), a sandstone slab bench and a slab-lined firepit with deflectors.

Room 3, in addition to the offset area, contained a wall that was rebuilt 8 in from a previously existing one. The room apparently was never closed in.

Outside the north wall another human jawbone was found below the surface. Cosgrove felt that the pueblo was occupied for a short time, as shown by the sheet distribution of trash and the grouping of pottery types. Unidentified coil utility wares contributed the largest percentage of sherds. Other types found in the rooms included Walnut Black-on-white, Chaco Black-on-white, Showlow Black-on-red and Walnut Black-on-red. Surface sherds included Showlow Coil with black interior, Showlow Plain with black interior, and Showlow Black-on-red coil, in addition to all the above mentioned types. The site chronologically is Pueblo III.

The pueblo was rebuilt and stabilized by the excavation crew. Other than judging and referencing pottery types, no analytic or comparative techniques were employed. The only interpretation discussed was that the pueblo was occupied for a short time.

(2) RIO PUERCO RUIN

LOCATION OF SITE: SE¼ of NE¼ of Section 9, Township 18 N, Range 24 E (USGS).

SITE DESCRIPTION: The Puerco Ruin is a rectangular 125-room Pueblo IV pueblo built around a plaza. It apparently stood one story high, had no exterior doors and windows, and had several rectangular kivas in the plaza. The pueblo stands at the pointed edge of a bluff that drops to the Puerco River at one edge and to a broad floodplain fed by a wash on the other edge. Looking away from the escarpment one sees the plain leading to Agate Bridge. A great number of rocks along the edge of the escarpment are covered with petroglyphs, including the misnamed but famous "stork carrying baby."

STRATEGY OF EXCAVATION: Strategy was conceived in terms of stabilization for public viewing. Several rooms in the southwestern corner were chosen for excavation and partial restoration because standing walls were higher than those of other rooms and because that corner would be more accessible to visitors viewing the ruin. Cosgrove also excavated a series of five trenches within the plaza in an attempt to discover trash heaps showing stratification, probably in order to establish temporal placement of the site or duration of occupation.

SAMPLING PROCEDURES: The three excavated rooms were 100 percent sampled. While depth and length of the trenches is noted, no width is given. It is not known, therefore, what percentage of the plaza area was sampled. No justification for areal choices is presented.

EXCAVATION PROCEDURES AND TECHNIQUES: Except in one instance, these are not described. When a stratified trash pocket was encountered in one of the trenches, the trash was removed in six-inch layers. There is no mention of horizontal controls in this area.

RESULTS: The subsurface remains of the pueblo were found to be in excellent condition. Walls were well made of sandstone slabs sealed with adobe. In many cases the plaster remained in place on the walls. Floors were easy to detect. Fill consisted of fallen wall material and windblown sand containing sherds.

Room 1 had two floors, the second apparently a renovation of the first, which was badly broken up. A firepit lined with sandstone slabs was discovered within each floor, although at different locations. The firepit in the second floor contained a burned juniper log. Also excavated were a bone awl, a lignite button or ornament and a cone-shaped shell.

Room 2 contained a bin extending completely across the room and separated from the rest of the room by upright sandstone slabs. Artifacts included two sandstone manos, five petrified wood hammerstones and the point of a bone awl.

Room 3 had been burned. In addition to preserving the plaster, the burning preserved many adobe casts of roof material showing grass and stick impressions. Artifacts included three sandstone manos, two petrified wood hammerstones and several worked sandstone slabs. The entire floor was covered to a depth of 2 in to 1 ft with burned corn cobs, both shelled and unshelled. There also were beans, both shelled and in the pod, as well as squash seeds and, possibly, a squash. In the center of the room were three restorable vessels: two Jeddito Black-on-yellow and an undecorated red Showlow bowl. Cosgrove concluded that this was a storeroom.

Excavation in the plaza trenches revealed a trash dump containing both mammal and bird bones, as well as pottery, ash and charcoal.

Pottery excavated from the rooms and from the plaza fall into the local form of the Homolovi focus (Reed 1947: 18), indicating 14th century occupation.

Analytic procedures consisted solely of typing the pottery. Interpretation consisted of judging Room 3 to be a storeroom and the rebuilt floor in Room 1 to have been executed simply to replace one that had disintegrated.

(3) THE FLATTOP SITE

LOCATION OF SITE: SE¼ of SW¼ of Section 32, Township 17 N, Range 24 E.

SITE DESCRIPTION: The Flattop Site is a village of at least 25 slab-lined pithouses. It is the only excavated site of a group comprising the earliest known sites in Petrified Forest National Park. Wendorf (1953) later conducted a thorough excavation of this site. Temporal placement is now generally conceded to be Basketmaker II. It is particularly interesting because it contains Mogollon or Sinagua brownware (Adamana Brown), along with Anasazi architecture. The location is on top of a small flat-topped mesa with difficult access.

THE EXCAVATION: Two pithouses were dug in an effort "to establish a floor level or other distinctive features such as the type of firepit." As Cosgrove states, "nothing of this sort was found." He offers no description of techniques, no analysis and no interpretation.

PROJECT EVALUATION: When considered solely in terms of the stated purpose, Cosgrove's strategies were suitable. When considered in terms of the quality of work described by other recognized archeological professionals of the day, both his fieldwork and report were below standard. Archeologists were then primarily interested in the chronological aspects of culture history, but these interests were predicated on accurate descriptions of the environment, site area, excavated areas, artifacts, soils and other aspects of the sites. Cosgrove's descriptions are incomplete and provide an inadequate basis for any conclusions or comparisons.

PROJECT TITLE: None (excavation of NA 4817, PEFO 171).

PRINCIPAL INVESTIGATOR: Bennett T. Gale, Assistant Park Naturalist, under the direction of Erik K. Reed, Regional Archeologist, NPS.

SPONSORING INSTITUTION: National Park Service.

DATES OF FIELDWORK: August 1941; number of days or person-days unspecified.

LOCATION OF SITE: NE¼ of SW¼ of Section 15, Township 18 N, Range 24 E

SITE DESCRIPTION: The site is a cave about two-thirds of the way up the exposure of a sandstone escarpment that forms a part of the plateau on which the Blue Forest and the Puerco Ruin are located. The Puerco Ruin is approximately 1½ miles north-northwest of the cave. Before excavation the cave measured 15½ ft across the entrance and 9 to 10 ft from front to rear, with recesses at the northwest and southwest corners. The surface contained scattered charcoal, potsherds, worked stone and sandstone slabs. Petroglyphs were carved into the sandstone above the mouth of the cave. What appeared to be a sandstone wall existed outside.

PURPOSE AND STRATEGY OF EXCAVATION: Because Reed's survey crew (Jepson 1941: 3) felt that seepage at the rear of the cave was destroying any archeological remains that might be there, excavation was ordered. The original strategy was to excavate exploratory tests of the cave. This produced only wood charcoal and the knowledge that the exterior wall was formed by natural cleaving from the sandstone cliffs. It was then decided to test trench the cave. Trenches were dug across the mouth of the cave, with lateral trenches extending to the rear along the side walls. When deposits were found to be very shallow (18 in maximum), Gale decided to excavate the entire cave.

SAMPLING PROCEDURE: The interior of the cave was 100 percent excavated. An exploratory test (site unspecified) was excavated outside the cave.

EXCAVATION PROCEDURES AND TECHNIQUES: No procedures or techniques are described.

RESULTS: The deposit within the cave varied from 18 in deep at the mouth to lensing out completely at the rear. No artifacts were found at a depth of more than 3 in. Dispersed through the fill were charcoal, small pieces of petrified wood, rodent bones, gypsum fragments, sandstone blocks and a pitch-like substance. There was no apparent stratification. Artifacts were grouped in three locations. Location 1 yielded 21 grayware sherds. Location 2 yielded one black-on-gray sherd, one moccasin, two wooden drills, one fire stick, corn kernels and cob, a partially burnt portion of a CCC newspaper, and numerous sticks of saltbush and greasewood. Location 3 yielded three gray sherds, a great deal of galleta grass and numberous sticks of saltbush and greasewood.

Gale decided that the petrified wood, gypsum and sandstone were natural falls from the roof. He felt that the grasses, bone material and possibly the pitch were the result of animal and insect activities. The charcoal and the newspaper were thought to be the result of recent lunch and warming breaks associated with a nearby CCC camp. Reed typed the sherds excavated. The appendix to his report (Reed 1947: 30) lists this site as belonging to the Homolovi horizon (early PIV), making it coeval with the Puerco Ruin. This is the only analysis of materials. There is no other interpretation of the archeological aspects of the site.

EVALUATION: The excavation strategy was valid and is still frequently in use. Techniques are not discussed. However, Gale was unable to detect stratigraphy (presumably change in soil color), which sometimes can be determined by careful control of horizontal and vertical units. There are no maps and no excavation photographs. The 100 percent sample is, of course, reliable. There are no archeological conclusions other than chronological placement. Gale's conclusions concerning the other materials appear to be valid.

REPORTS:

Gale, Bennett T.
    1941 The excavation of archaeological site 171, Petrified Forest National Monument. Manuscript on file Western Archeological Center, NPS, Tucson.

Jepson, Carl E.
    1941 Dwelling places of the prehistoric Indians in the Petrified Forest National Monument. Typescript report on file Western Archeological Center, NPS, Tucson.

Reed, Erik K.
    1947 Special report on review of archaeological survey potsherd collections, Petrified Forest National Monument, Arizona. Typescript report on file Western Archeological Center, NPS, Tucson (included in this volume as Appendix II).

COLLECTIONS: At least one box of artifacts from this site is stored at the Museum of Northern Arizona. There are no other known existing collections.

PROJECT TITLE: None (survey).

PRINCIPAL INVESTIGATOR: Erik K. Reed.

SPONSORING INSTITUTION: National Park Service and the Museum of Northern Arizona.

DATES OF FIELDWORK: December through March 1941.

LOCATION OF SURVEY: The survey included all of Petrified Forest National Park south of the Puerco River (USGS 15' Quad, Petrified Forest National Park, AZ 1955). This area encompasses approximately 51 mi^2.

PURPOSE OF SURVEY: The survey originally was designed to relocate and stake all sites previously located by Mera and to collect eroded artifacts. However, when surveyors discovered a great many previously unrecorded sites a decision was made to do a complete survey of the monument. This apparently was discontinued when the southern half was completed. A few surveyed sites north of the Puerco River appear on field maps and site cards, but they are not mentioned in the reports.

TECHNIQUES AND INTENSITY OF SURVEY: The field crew, consisting of two park naturalists, surveyed two days a week, covering all lands except those in extremely rough country and badlands areas. No mention is made of actual techniques used to assure location of all sites in the topographic areas selected. Site locations were recorded on a USGS 15' topographic map.

Information recovery was ambiguous. An attempt was made to judge the number of rooms for each pueblo and the condition of the ruin.

Surveyors collected from each site. Neither the extent nor the method of choosing the sample is stated. No site maps were drawn. No attempt was made to show the complete extent of the site. No other features, such as slab-lined cists, were recorded. No environmental, topographic (other than map locations), or other information was recorded.

SUMMARY OF RESULTS: The survey and analyses corroborated Mera's work and was supported by more quantification, which provides a firmer basis for conclusions. Three hundred and four sites, ranging from Basketmaker III through Pueblo IV (ca. AD 300 to AD 1350), were located. The survey located mostly pueblo and pithouse sites, but several sherd scatters and one cave also were discovered. No aceramic sites were recorded, nor were petroglyphs or other site types.

Pueblos ranged in size from 1 to 125 rooms. The major building materials for the pueblos were sandstone or petrified wood, although the remains of some adobe pueblos were discovered. Visible portions of pithouses usually consisted of upright vertical sandstone slabs. Although most sites were located on flat-topped mesas near the edges of escarpments, the remaining sites occupied a wide range of locations. These included sites on dune ridges, in low valleys, on steep slopes, at the bottoms of mesas and sites wedged between large boulders on slopes. Many sites were suffering from erosional and other environmental damage.

Artifacts included pottery, numerous manos and metates, numerous hammerstones, relatively few points and several bone implements.

Jepson (1941), one of the surveyors who was not a trained archeologist but was a very astute observer, made several observations that are unquantified but are very suitable for testing. First, sites generally are located near sources of building stones, but distance from possible water sources or tillable land seemed to be unimportant. Second, groups of sites may have been arranged in such a way as to easily display subsistence and/or social organizational aspects. He noted that at three separate locations (unspecified) a site with an extraordinary number of metates also had a large number of sites within a half-mile radius. He suggests community grinding. The possibilities of sophisticated studies stemming from settlement pattern-activity correlations such as this are infinite. His third observation deals with an unusual situation involving lithics. There was a great deal of evidence of flaking activity, but few tools other than hammerstones were found. There were very few points in relation to the entire lithic complex, and some of the points were made from lithics unobtainable within the Petrified Forest area. Jepson suggests that hunting was not an important subsistence technique and that petrified wood was being quarried for trade.

There were no quantified analyses of materials other than ceramics. Two separate ceramic analyses were executed with different purposes in mind. Reed's (1947) study included ceramics from 340 sherd collections, representing 280 sites. The purpose was primarily to assign sites to temporal periods on the basis of the sherds represented. He does not mention specifically which attributes were noted for the study. The analysis was based on his own intimate knowledge of the ceramics of the area, as well as on the published literature of the time. Lists of pottery types and horizons were developed and were compared with each other and with the general region (see Appendix II).

Reed found a general correspondence to various foci developed by Colton (1939). Within these similarities were variations and differences, which he felt were worthy of note but not important enough for the delineation of new types. He concluded that occupation within the park was continuous from about AD 500 to AD

1400. He felt that Mera's temporal designation for Adamana sites was too late and placed them in Basketmaker III, that is, probably as early as AD 500 and definitely before AD 750. While he previously had noted an absence of Pueblo I sites (Reed in Jepson 1941), he felt after fuller analysis that this lack was more apparent than real (Reed 1947). All sites in the park were dated on the basis of tradewares, in association with undated wares probably made within the park. It is possible that no tradewares were imported during that period, so that sites that overlapped in time could have been dated too early or too late. Further, he concluded that all black-and-white wares, as well as some other ceramics made after 1100, were obtained by trade.

Wendorf (1948, 1953) in a later study selected very early sites for ceramic analysis, primarily those pre-dating Pueblo III. He preferred to study 100 sites, which necessitated the addition of a few Pueblo III sites selected at random. Following Colton's (1946: 248-250) method, he established several ceramic groups. Later reexamination showed that his first two groups should be combined (Wendorf 1953: 19). By cross-dating and comparison, temporal periods were established for the various ceramic groups.

Wendorf concluded, as had Reed, that sites exhibiting only Adamana pottery were earlier than suggested by Mera. He felt that they were pre-AD 500. Only four sites exhibited pottery from about AD 800 (PI), indicating, he felt, a population decrease during this period. At the same time a regional comparison showed an increase in population in mountainous sites (Mogollon). Two hundred four sites remained, which were not examined by Wendorf. He felt that this indicated a population increase from the end of Pueblo II, especially in late Pueblo III and possibly in Pueblo IV.

EVALUATION: The survey strategy and techniques were effective, in that they allowed location and temporal placement of most sites in the southern section of the park. Reliability and extent of the sample are almost impossible to judge. The surveyors chose to record pueblos and slab-lined pithouses, but not lithic or sherd scatters. Wendorf (1953) later discovered and partially excavated the Twin Buttes Site, the largest known Basketmaker III site in the park area, which was missed by the survey crew. Lithic scatters, mentioned but not recorded by both Jepson and Mera, and other sorts of less obvious sites (i.e., water control devices, petroglyphs, agricultural fields) can be considered as not sampled at all.

Several points should be noted. First, because the surveyors opted for certain topographic areas, we have no knowledge of the extent of settlement in the others. Because the exact techniques of searching the park are not discussed, the extent of coverage of the specified topographic areas is unknown. Jepson (1941: 6) states that he feels that a number of sites were overlooked. Second, information recovery could have been greatly increased by drawing sketch or measured maps of each site, by delineating the total site area with features and activity areas, by analyzing artifacts in addition to ceramics, especially lithics, and by detailing architectural information.

Given the extent and type of information recovery, the conclusions of the researchers are logical and valid. They have been used and are now being used as a basis for comparison and formulation of hypotheses for other research in the region.

REPORTS:

Jepson, Carl E.
1941 Dwelling places of the prehistoric Indians in the Petrified Forest National Monument. Typescript report on file Western Archeological Center, NPS, Tucson.

Reed, Erik K.
1947 Special report on review of archeological survey pot-

sherd collections, Petrified Forest National Monument, Arizona. Typescript report on file Western Archeological Center, NPS, Tucson.

Wendorf, Fred

1948 Early archaeological sites in the Petrified Forest National Monument. Plateau 2: 29-32.

1953 Archaeological studies in the Petrified Forest National Monument. Museum of Northern Arizona, Bulletin 27.

LOCATION OF COLLECTIONS, FIELD RECORDS, MANUSCRIPTS:

Field Records: (1) Field notes of Jepson et al in Petrified Forest National Park Archeological File. (2) Site cards of Jepson et al: originals on file Petrified Forest National Park Archeological File, copies at Western Archeological Center, NPS, Tucson. (3) Wendorf's original notes, pottery sheets, etc., located in Unknown Quad File, Museum of Northern Arizona.

Collections: Reed's (1947) report states that there originally were 340 analyzed sherd collections at the park, representing 280 sites. There were also 90 collections representing an unknown number of sites at the park, which were not analyzed. At that time he states that 205 collections, representing an unstated number of sites, were sent to the Museum of Northern Arizona. The museum now has sherd collections representing 255 sites from that survey. Obviously, some collections have been added.

It is possible that some of the collections held by the museum later were given to them by Reed and that no correspondence related to that transfer now exists. Reed also states that the rest of the collections either were thrown away or were kept at the park as type collections. They are no longer stored at the park. A series of letters (Museum Records file, Western Archeological Center) between various officials at the Southwestern Archeological Center at Globe and the park reveal that at least 14 cartons of archeological materials were receipted from the park to the center. Some (at least nine) were boxes of sherds that were uncatalogued and had no provenience, partly as a result of a basement flood at the park. At any rate, none of the boxes of sherds can be located.

In summary, the only known collections from this survey are those from 255 sites located at the Museum of Northern Arizona.

PROJECT TITLE: No title given. Excavation of two sites was undertaken in partial fulfillment of the requirements for Wendorf's Ph. D. degree, Department of Anthropology, Harvard University.

PRINCIPAL INVESTIGATOR: Fred Wendorf.

SPONSORING INSTITUTION: Financial support came from the Wenner-Gren Foundation (then Viking Fund, Inc.) and the Colt Archaeological Institute; equipment came from the Laboratory of Anthropology, Santa Fe.

DATES OF FIELDWORK: Summer field seasons of 1949 and 1950. No exact amount of time is given. However, two weeks of the first season and all of the second season were devoted to the more complex Twin Buttes Site.

EXCAVATION SUMMARY: Two sites were excavated and are summarized separately below.

(1) FLATTOP SITE (NA 4715, PEFO 25)

LOCATION OF SITE: SE¼ of the SW¼ of Section 32, Township 17 N, Range 24 E (USGS 15' Quad, Petrified Forest National Park).

SITE DESCRIPTION: The Flattop Site is a Basketmaker II village of 25 slab-lined pithouses. It is the largest of 13 known "pure" sites, which contain Adamana Brown, the earliest known pottery in the park area. The pithouses are scattered along the southern and eastern edges of one of the Flattop mesas, which rise to a maximum altitude of 5700 ft in the southern section of the park. These mesas stand out in high relief (100+ ft) from the surrounding plain. The mesa upon which the site is located is composed of layers of eroding bentonite and sandstone, with a 10 to 15 ft sandstone cap, all of which is a portion of the Chinle Formation. While in some areas the sandstone on top of the mesa has no cover, the major portion is covered with up to 50 cm of wind-deposited sandy soil. Vegetation, consisting of bunch grass and low shrubs, grows wherever the soil cover is deep enough to permit it.

PURPOSE AND STRATEGY OF THE EXCAVATION: The 1934 and 1941 National Park Service surveys had indicated many early sites with unknown archeology and relative chronology. Wendorf was interested in the period just after pottery was first introduced to the park area. His primary purpose was to correlate the earliest pottery horizons discovered in his analysis with adjacent areas, on the basis of stratigraphic and comparative data. A secondary purpose was to document the effects of two different cultural groups (Anasazi and Mogollon) on one another in a "frontier" area.

Mera's type site for Adamana Brown was used to delineate the earliest horizon because it was felt it would give a larger sample. Wendorf then chose to dig a later Basketmaker III site for comparison and seriation. When it was discovered that all known BMIII sites in the park were small, he and his crew searched and found the Twin Buttes Site, which had been undiscovered by the survey teams.

Specific strategy for the Flattop Site was simply to excavate eight of the 25 structures observable on the surface. While it is not stated, he probably chose these houses because some unusual characteristics of each showed (and still show) on the surface, such as greater size, wing walls, interior storage bin, exterior storage bin, etc. Specific strategy for the Twin Buttes Site is discussed below.

SAMPLING PROCEDURE: Wendorf practiced judgmental sampling, that is, no statistically controlled sampling techniques were used. Areas to be excavated were chosen on the basis of prior experience and comparative literature. Eight of 25 houses, or 32 percent of the structures apparent on the surface, were excavated. Since areas between houses were not excavated, the percentage of the total site sampled is unknown.

EXCAVATION PROCEDURES AND TECHNIQUES: "Before each house was excavated it was photographed and all surface sherds and debris were removed from the area of intended excavation. A small pit was then begun on the inside of the house against one wall and continued downward until the floor was reached. The pit was then expanded into a trench which followed along the walls until the entire house was then removed. After the fill had been removed an area 50 cm wide surrounding the house was stripped to determine if there were other features not evident from the surface. When this was complete the house was photographed and carefully mapped.

"The standard procedure in handling artifacts was the same for both sites. Sherds from the fill of each structure were saved and sacked together while those sherds found in contact with the floor were sacked separately. All sacks were labeled with the date, site and house number, location in the house, type of contents and the initials of the recorder. Artifacts were left in situ until the house had been cleaned, photographed and mapped, at which time they were carried to our field camp for cleaning and cataloging" (Wendorf 1953: 21-22).

RESULTS: The eight houses excavated were all circular to oval in outline and were 2-3 m in diameter. They were dug to bedrock, an average of 50 cm deep. They were either completely or partially outlined with vertical sandstone slabs. Several had small slab-lined storage bins inside or just outside the house. Two houses had wing walls, which ran diagonally from the entrance and appeared to shield the interior from the entrance without separating the house into two rooms. Most had lateral, slightly sloping entranceways. Floors were pecked out of bedrock and, in some cases, were filled with sand for leveling. Remains of superstructures included poles, brush and mud, possibly with sandstone slabs to help hold the brush in place. Because of the placement of metates within the room, Wendorf speculates that the superstructure might not have been solid and would have let in the light. Slab-lined hearths were excavated outside of or between houses. There was not, however, one hearth per structure outlined on the surface.

Only one structure, House N, contained a firepit or hearth of any sort, although many showed ill defined ash areas on the floor. House N also was larger and deeper than the other structures. It had no entranceway and had been abandoned by the time some of the other structures were occupied. Wendorf feels this may be a very early example or equivalent of a "great house," which probably functioned, at least partially, as a ceremonial room.

Most excavated pottery was Adamana Brown. Although there were some PIII sherds on the surface, these were probably carried over from a PIII site on an adjoining mesa. Within the fill and floor were 83 sherds of unidentifiable and restorable brownware, including fibre-tempered ware. Several sherds were scored as were those from the Pioneer phase at Snaketown. Forms primarily included deep hemispherical bowls, globular jars with restricted orifices and no necks, and large, slightly elongated globular jars with tall vertical or slightly tapering restricted necks.

Metates, contrary to the findings of Mera at Adamana sites, were primarily troughed and open-ended, with the near end shelflike (similar or equivalent to the "Utah" type). There was one basin metate. Manos were primarily subrectangular. Other ground stone artifacts included bowls, balls, pipes and discs. The primary material used was sandstone, but vesicular basalt, fossil bone and other materials also were used.

The primary material for chipped lithics was petrified wood (60 percent). Artifacts included utilized and unutilized flakes, scrapers, knives, gravers, choppers, bifaces and points. Most points were large and equivalent in shape to BMII (Anasazi), San Pedro Stage, Cochise Culture, and pre-pottery stages at Ventana Cave. There was one reworked fluted point made of petrified wood. These points help to confirm Wendorf's pre-AD 500 date for the site.

Floral remains included corncobs, juniper, cottonwood and unidentified reeds. There were few faunal remains. The tested pH content of the soils shows that bones and shell would have been preserved. Wendorf concluded that very little hunting occurred near the site.

On the basis of comparison with Mogollon and Anasazi sites known to date within the 600 years prior to AD 500, Wendorf placed the site by seriation at pre-AD 500, or Basketmaker II. There are no absolute dates. He feels agriculture was the primary subsistence pursuit at the site, with possible seasonal occupation. He detects more general agreement with Anasazi than with other major groups.

(2) TWIN BUTTES SITE (NA 5065, PEFO 137; formerly NA 4837)

LOCATION OF SITE: NW¼ of the NE¼, Section 15, T 17 N, R 24 E (USGS 15' Quad, Petrified Forest National Park).

SITE DESCRIPTION: This is a diverse BMII-PI permanent habitation site. It covers an eroding butte-like mound connected by a spur to Crystal Mesa, as well as much of the flatter area nearby. The butte and spur are dissipated bentonite and sandstone remnants of the Chinle Formation. Large and small chunks of petrified wood cover this and nearby areas. The entire site and surrounding territory are eroding badly.

Almost no vegetation is found on the butte and spur areas. The plains below have a deep sandy topsoil ranging to active dunes. They are covered with bunch grass and low bush vegetation, such as Mormon tea, snakeweed and saltbush.

Except along the southern side of the butte, known architectural units are widely scattered. The only known BMII architectural remains are two deep adobe and stone-walled granaries. BMIII architecture consists of connected or closely associated groups of slab-lined surface storage units arranged in a crescent. A completely subsurface pithouse (in one case, a protokiva) usually is located nearby. There are occasional isolated storage units and pits. One portion of the southern side of the butte has deep trash deposits, into which burials have been dug. The southeastern section of the butte has surface vertical alignments of large stones, which probably were used for sand dune farming.

The site apparently was occupied continuously from BMII (probably equivalent to or near the date for the Flattop Site) until the beginning of PI, or 300+ years. It appears to exhibit almost the full range of human activity related to a permanent habitation site.

PURPOSE AND STRATEGY OF EXCAVATION: The purpose was the same as that at the Flattop Site. Because of the giant size of the site and its combination of pithouses, rock alignments and widely separated crescentic groups of surface structures, Wendorf conducted a series of test excavations, both in structures and in large trenches, in order to determine the general character of the architecture and the chronologically significant portions of the site. During the first season four slab-lined structures of varying sizes and shapes, along with a test pit in deep trash, were excavated. The test pit happened accidentially to be situated in the middle of a sunken granary.

The second season addressed three problems: (1) stratigraphy--a long deep test trench was sunk in the same area as the previous year's test pit; (2) explanation of stone alignments--a test pit was sunk adjacent to one of the alignments, and (3) explanation of the crescentic groups of slab-lined structures--several surface structures were excavated and trenches were dug out from them until the pithouses were located.

SAMPLING PROCEDURES: The procedures were judgmental in that no probabilistic sampling techniques were employed. Sampling consisted of excavating in, through or near one of each different shape or group of shapes apparent on the surface. Judging from the map and the amount of unexpected material found in the test trenches, the total percentage of the area sampled was considerably less than 5 percent.

EXCAVATION PROCEDURES AND TECHNIQUES: These were the same as those used at the Flattop Site. Two stratigraphic tests also were conducted in test pits at each end of the trench through the trash area. Pottery was removed in units 25 cm deep. Length and width of the units is not clearly stated, but they probably were 1 m by 2 m. The material was screened and an effort was made to keep the two units equivalent.

The procedures and techniques were eminently suitable for Wendorf's purposes, which were seriation and comparison. The results produced were exactly those expected.

RESULTS: Indications of Basketmaker II were discovered in only one area, Test Trench I. These consisted of two pits and two deep (3 m) stone and adobe-lined granaries, which were used through the earlier part of Basketmaker III and were then filled with trash as their use was discontinued.

The site pattern for Basketmaker III, which was visible on the surface, revealed 15 widely separated crescentic architectural groups, along with scattered isolated storage units and long rock alignments indicative of agricultural fields. The crescentic groups consisted of several semisubterranean slab-lined storage structures connected to form a crescent, with one or more pithouses located in front of the arc. There was a great deal of evidence suggesting that these storage units also were used as work areas. These structures were circular to oval in shape and lined with boulders or sandstone slabs. They had a diameter of 2 to 4 m. Floors either were plastered or were packed with sand; occasional traces of plaster were visible along the bases of walls. The type of superstructure is unknown. While some units contained no interior features, others contained benches, bell-shaped pits or shallow round pits. There were no defined hearths, but burned areas did exist.

The two associated pithouses were much deeper (1.5 m), larger (more than 4 m in diameter) and had a different total configuration. There was a difference, as well, between the classes of artifacts within the pithouses and those in the storage structures. The one totally excavated pithouse (F 4) contained a ventilator, a bench completely encircling the house, and a four-post roof support arrangement. Other features included an ash pit and a clay-lined firepit. Structure D 4 was excavated only where Trench 1 bisected it. It, too, contained a clay-lined firepit, along with a sipapu and a deflector. On the basis of the presence/absence of a ventilator, F 4 was designated a "protokiva" and D 4 a pithouse.

A wide range of artifacts was recovered. Pottery included brownwares, probably representing the Mogollon sphere of influence, and graywares, probably representing the Anasazi sphere of influence. Brownwares included the Alma series and the Forestdale series, as well as Adamana Brown. Grayware included Lino Gray, Lino Fugitive Red, Kana'a Gray, Lino Red (Tallahogan Red), Lino Smudged, Lino Black-on-gray, and White Mound Black-on-white. Stratigraphic tests revealed that slightly more gray than brown ware was utilized through time.

Ground stone included troughed and open-ended metates. The near end had a shelf, which sometimes had a depression. Manos included one-handed circular to oval, unshaped or slightly shaped blocks, and subrectangular with parallel sides and rounded ends. There were no basin metates to match up with the one-handed manos. Other ground stone artifacts included mortars, abraders, grooved abraders, rubbing stones, discs, stone balls, stone pipes and pipe blanks, grooved axes, a grooved maul, a notched maul and other items.

Chipped stone artifacts included points with pressure retouch, blades, bifaces, gravers, scrapers, drills and choppers. Point types compare with those from excavated sites that date from Basketmaker II through PI.

There also were worked bone and antler artifacts. Significantly, there were quite a few shell artifacts, which had to represent trade. Most of the shells came from the Gulf of California or the California coast.

There also were charred textile fragments made from unidentified vegetal fibres. Other vegetal materials included charred corncobs of unidentified species. Faunal evidence excavated included bones of antelope, dog, eagle, cottontail, badger, prairie dog, hawk and possibly coyote. Two turkey burials were recovered from the trash mounds.

Eight human burials were recovered. All but one located in F 4, which was probably intrusive, were contemporaneous with the site. All but the one in F 4 were located in trash areas. Burials usually were semiflexed or flexed, with the head to the west or southwest, or on the back with the knees drawn up. Associated pottery was of the Forestdale series only.

Wendorf concluded that the site was a Basketmaker III habitation site with agricultural fields. He decided that most of the architectural resemblances were Anasazi. On the basis of the grayware, he assigned the site to the White Mountain phase (Aspect), following Gladwin (1945). He considered the Twin Buttes Site to be the locus of a major concentration of population in the region for the period. Based on these conclusions, he decided that the grayware was made on site and that the brownware was traded in. He also concluded that trade in petrified wood probably occurred, because the numbers of hammerstones and the abundant lithic remains seemed to outstrip the needs of the community. Wendorf mentions the many similarities to Mogollon sites, as well as several resemblances to and/or traded items from the Hohokam.

Wendorf simply describes most artifacts and excavated units. Particular, sometimes singular, aspects of pottery, architecture and other aspects of the site are then compared with other Southwestern sites with similar characteristics. However, Anna O. Sheppard (in Wendorf 1953: 177-193), on the basis of an excellent series of comparative chemical and other tests, concludes that the grayware and brownware series were definitely made from two different types of clays. The colors, then, are not the results of differential firing of the same clay. She considers four distinct possibilities for the origins of the two distinct types of pottery and suggests searching the region for both clay and temper types in order to qualify statements concerning trade or on-site pottery production.

EVALUATION: The combination of Wendorf's excavation and report is the most thorough and best executed of all reported studies in the park. The techniques, procedures and extraction of information are impeccable for the late 1940s. His use of environmental considerations for site and agricultural locations is particularly interesting and by far exceeds evaluations of all other published excavators within the park.

It is almost impossible to judge the validity of the sample, since no comparable material has been excavated in the area. Two points are important here: (1) judgmental sampling is notoriously biased, and (2) on the basis of the extent and variation of material located in a test trench designed primarily for stratigraphic purposes, it is likely that variation in surficial manifestations is a poor indicator of the extent and variation of the total site. It is likely that the sample is biased in terms of chronology, area and activities carried out there.

Wendorf's conclusions are biased. This, of course, is partly related to the sample, but it also is related to his unwillingness to leave questions unanswered when there was not enough information to answer them, and his willingness to utilize one trait only, disregarding all others, to define chronological or cultural affiliations. This effort to "tidy up" loose ends can result in the drawing of unwarranted conclusions, particularly those related to the "frontier," or cultural interaction, aspects of the site.

REPORTS:

Wendorf, Fred
1953 Archaeological studies in the Petrified Forest National Monument. Museum of Northern Arizona, Bulletin 27.

LOCATION OF COLLECTIONS, FIELD RECORDS, MANUSCRIPTS: The Museum of Northern Arizona has stored boxes of artifacts from both sites. They also hold on file the original excavation records for both sites, as well as the original catalog and burial cards for both sites. Their photography files contain environmental, work and artifact photographs from both sites.

PROJECT TITLE: Mission 66 Program (excavation of Puerco Ruin, NA 6302).

PRINCIPAL INVESTIGATOR: Albert H. Schroeder.

SPONSORING INSTITUTION: National Park Service.

DATES OF FIELDWORK: August 1957; May 1958.

LOCATION OF SITE: SE¼ of NE¼ of Section 9, Township 18 N, Range 24 E (USGS 15' Quad, Petrified Forest National Park).

SITE DESCRIPTION: The Puerco Ruin is a 125-room pueblo (late PIII-PIV) built in a rectangular shape around a plaza. It apparently stood one story high, had no exterior doors and had several rectangular kivas in the plaza. The pueblo stands at the pointed edge of a bluff that drops to the Puerco River at one edge and to a broad floodplain fed by a wash on the other edge. Looking away from the escarpment one sees the plain leading to Agate Bridge. A great number of rocks along the edge of the escarpment are covered with petroglyphs.

PURPOSE AND STRATEGY OF EXCAVATION: The excavations were undertaken as a visitor development or interpretive project. Strategy, presumably to give visitors a broader perspective of the many aspects of a large pueblo, began in 1957 with the excavation of several rooms on the south end of the quadrangle and testing of a kiva in the plaza. In 1958 the southwest corner and a few rooms next to it, as well as the kiva, were totally excavated. The walls were then stabilized.

SAMPLING PROCEDURES: All excavated areas were 100 percent sampled. No reason was given for room choices.

EXCAVATION PROCEDURES AND TECHNIQUES: There is no information on excavation procedures and techniques, either in publications or field notes.

RESULTS: The Puerco Ruin consists of rectangular rooms, which average 13 ft by 6 to 7 ft, arranged in a rectangular shape around a plaza. One rectangular kiva was excavated within the plaza. There are no exterior doors from the rooms away from the pueblo or into the plaza itself, entrance apparently having been through hatchways in the roof. A few of the rooms had been burned. Few artifacts were left on the floors. Floors were covered with a thin layer of aeolian sand and, in some cases, roof remains. On the basis of these arrangements and remains, Schroeder concluded that the pueblo was planned and built all at one time and that the people who abandoned the pueblo did so by choice and not under duress (that is, attack; environmental duress probably existed). He also suggested that the pueblo was built without exterior doors in order to provide dust and wind protection.

Features such as slab-lined hearths, firepits and grinding bins existed in various rooms. The floors and walls had been plastered. On the bases of features and material recovered within the rooms, Schroeder determined that groups of rooms, usually three, were blocked into family living units with interior doorways. These usually consisted of a general purpose room, a food preparation room and a storage room.

Extending from beneath the northwest corner room were portions of a circular and a straight wall from an earlier occupation. The lower occupation was not excavated.

The rectangular kiva measured 13 ft 4 in by 9 ft 9 in, with a bench 1 ft 4 in wide and 4 ft deep at the south end of the floor. The stones lining the walls evidently had been removed and evidence of Indian reutilization existed 1.5 ft below the present ground surface. Portions of the kiva had been previously excavated. Schroeder suggested that when a new kiva was built the stones from the old were removed and reused.

The pottery assemblage is typical of the Puerco-Leroux drainage between AD 1250 and 1350. A few sherds dating from AD 1100-1250 were found in the fill from the kiva and Room 8, which had been burned. Schroeder attributes this to excavation of a new kiva at the site by the pueblo dwellers themselves, with the abandoned kiva and room being used as a convenient receptacle.

Schroeder considers Homolovi Corrugated, Black Ax Plain and Homolovi Red, Black-on-red, White-on-red and Polychrome to have been made locally. Jeddito Black-on-yellow is the most common tradeware. Zuni glazes exist, but are rare. Varieties of Gila Polychrome exist, but they exhibit a local paste. Two new pottery types, Homolovi Red and Homolovi White-on-red, are described. In addition, Schroeder describes a site utilized as a local source for temper.

Manos, metates, polishing stones, utilized flakes and an arrowshaft straightener were recovered. Extensive vegetal material (identified by Voleny Jones, Ethnobotanical Laboratory, University of Michigan) included corncobs and bushels of kernels, beans (Phaseolus vulgaris) and pumpkin seed (Cucurbita mixta). The only definitely prehistoric faunal material was the unburned humerus of an eared grebe (Podiceps caspicus) found in a slab-lined pit in the plaza.

EVALUATION: Excavation strategy, techniques and sample cannot be evaluated, since they are not discussed. Schroeder's conclusions in general appear to be valid, although many must be quantified. Since no description of any sort of comparative analysis was published or noted, one wonders why some types of pottery were considered locally made and others were considered tradewares.

The contributions of the study by current expectations are many, particularly the hypotheses concerning the lifeways of the pueblo dwellers. However, the failure to document strategy and techniques is unfortunate.

REPORTS:

Schroeder, Albert H.
1960 Excavations in the Puerco Ruin. Manuscript on file Western Archeological Center, NPS, Tucson.

1961 Puerco Ruin excavations, Petrified Forest National Monument, Arizona. Plateau (33) 4.

PROJECT TITLE: None (excavation of Puerco Ruin, NA 6302).

PRINCIPAL INVESTIGATOR: Calvin H. Jennings.

SPONSORING INSTITUTION: Museum of Northern Arizona and National Park Service.

DATES OF FIELDWORK: March 28 to April 7, 1967.

LOCATION OF THE SITE: SE¼ of NE¼ of Section 9, Township 18 N, Range 24 E (USGS 15' Quad, Petrified Forest National Park).

SITE DESCRIPTION: The Puerco Ruin is a 125-room pueblo (late PIII-PIV) built in a rectangular shape around a plaza. It apparently stood one-story high, had no exterior doors, and had several rectangular kivas in the plaza. The pueblo stands at the pointed edge of a bluff that drops to the Puerco River at one edge and to a broad floodplain fed by a wash on the other edge. Looking away from the escarpment one sees the plain leading to Agate Bridge. A great number of rocks along the edge of the escarpment are covered with petroglyphs.

PURPOSE AND STRATEGY OF EXCAVATION: There were two stated purposes: "The first was to expose yet another portion of the ruin in hopes of giving the visitor a better understanding of the nature of the structure and of its relation to the geographic locale. The second objective was to gain enough information to determine whether or not more complete study of the site would be warranted at some future date" (Jennings 1967: 2).

No excavation strategy is documented.

SAMPLING PROCEDURES: Rooms chosen were 100 percent excavated. No reasons for room choices are given.

EXCAVATION PROCEDURES AND TECHNIQUES: There is no documentation of these.

RESULTS: Jennings excavated 15 rooms and two kivas, bringing the total of excavated rooms in the pueblo to 33. Preliminary findings corroborate Schroeders' conclusions or hypotheses. Jennings mentions the fact that there seemed to be a great deal of intercourse with Hopi and Zuni pueblos, judged on the basis of excavated pottery. He again noted the extensive vegetal remains and suggested that the Indians were excellent farmers.

Kiva 2, which measured 5.85 m by 4.23 m, had plastered walls without a masonry liner. Masonry apparently was later added to the bench. Kiva 3 measured 3.81 m by 2.05 m and the lower half was masonry lined with plaster over all. A secondary burial of an adult was discovered in the fill of the ventilator tunnel of Kiva 3.

EVALUATION: Although the excavation occurred in 1967, only a preliminary report, amounting to a descriptive outline of some of the material encountered, has been submitted. The final report is scheduled for completion in 1979. Evaluation before the final report would be premature.

REPORT:

Jennings, Calvin H.
1967 1967 excavations at the Puerco Site, preliminary report. Manuscript on file Western Archeological Center, NPS, Tucson.

RECORDS: All collections are stored at the Museum of Northern Arizona. Photographs, catalog cards and site cards for the Puerco

Site are on loan to Calvin Jennings. Dendrochronological samples are on loan to the Laboratory of Tree-Ring Research, University of Arizona. Three Homolovi Corrugated pots are on loan to California State University.

PROJECT TITLE: FY 1971-NPS Contract #4970P10170 (excavation).

PRINCIPAL INVESTIGATOR: Bruce G. Harrill.

SPONSORING INSTITUTIONS: Museum of Northern Arizona and National Park Service.

SITE NUMBER: NA 10,808; Arizona Q:1:1 (MNA); Arizona Q:1:20 (ASM). This site was designated NA 4730 or PEFO 30 in the original NPS survey of the park.

LOCATION: NE¼ of Section 11, Township 16 N, Range 24 E (USGS 15' Quad, Petrified Forest National Park).

SITE DESCRIPTION: NA 10,808 is a small Mogollon "campsite" and is approximately .3 mile west of Jim Camp Wash at an elevation of 5450 ft. It is located on a sandy and grass-covered ridge extending from the base of a gentle slope. Excavated features include three partially deteriorated slab-lined hearths, a shallow pit 2.0 m in diameter, a smaller circular bowl-shaped pit, and an amorphous feature composed of a scatter of sandstone boulders. The site was intermittently occupied between AD 1150 and AD 1300. It is postulated that the site functioned as a field house.

PURPOSE AND STRATEGY OF EXCAVATION: The excavation was undertaken to clear a proposed right-of-way for an access road extension (Park Route 1) in the southern portion of the park.

A trench 1.0 m wide was dug across the site to determine the depth of cultural material. Fourteen trenches (15 m by 1 m by 20 cm) were then dug. Areas surrounding cultural features were stripped.

SAMPLING PROCEDURES: Sampling procedures are not described. There are no maps that describe the exact areas where the 14 trenches were excavated, nor is there any description of the exact area stripped around features. The trenches covered 210 m^2 of the 800 m^2 site, or 26 percent of the total surface area.

EXCAVATION PROCEDURES AND TECHNIQUES: The only technique mentioned is that hand labor was used. There is no mention of horizontal and vertical controls, recovery techniques, or their relationships to purposes and results.

RESULTS: Harrill concluded that the site was a "campsite" or possible field house used while hunting and gathering or for field-tending activities intermittently between AD 1150 and 1300. The primary cultural affiliation, judged on the basis of percentages of pottery types, is considered to be Mogollon. The site contained three partly destroyed slab-lined hearths, a shallow pit, a fire or ash pit, and an amorphous boulder feature, which may have been the remains of a one or two-room field house. There was evidence for processing of both plant and animal foods in the artifact assemblage.

The most numerous types of painted pottery recovered were St. Johns Black-on-red, Gila Polychrome, Kokop Black-on-white and Showlow Black-on-red. There was more brown corrugated ware than any other type. Ground stone included subrectangular, unifacial, two-handed manos, two slab metates and one incised sandstone slab. Chipped stone included scrapers, several "knives" and a drill. Both utilized and unutilized flakes were recovered; lithic debris covered the site. Seven hammerstones, as well as a combination hammerstone/arrowshaft straightener, were recovered. Primary lithic materials were petrified wood and chert.

Artifacts were described but not analyzed. Harrill's interpretation and conclusions are consistent with the site contents.

EVALUATION: Because of the lack of description it is impossible to evaluate the effectiveness of excavation strategy and techniques or the reliability of the sample. Harrill's conclusions probably are valid. However, a comparison of site configuration and artifactual materials from other excavated field houses and/or small pueblos in the region would have greatly increased one's confidence.

The lack of research goals, whether formally stated or not, the site and artifact description without analysis or comparison, and the lack of description of basic techniques weaken the report. The site obviously was badly eroded and/or otherwise disturbed, but studies, such as of lithic extraction methods (Was lithic material being manufactured here for use at a nearby larger site?) or of subsistence or other activity areas, would have been helpful.

REPORTS:

Harrill, Bruce G.

1970 Archaeological salvage in a small pueblo ruin on the South Entrance Road of Petrified Forest National Park, Navajo County, Arizona. Interim Report. Manuscript on file Western Archeological Center, NPS, Tucson.

1971 Archaeological salvage in a small pueblo ruin NA 10,808 on the South Entrance Road of Petrified Forest National Park, Navajo County, Arizona. Final report. Manuscript on file Western Archeological Center, NPS, Tucson.

1972 Archaeological salvage in a prehistoric campsite, Petrified Forest National Park. Plateau (44) 4.

RECORDS: All collections, field records and photographs are stored at the Museum of Northern Arizona, Flagstaff.

PROJECT TITLE: List of Classified Structures Survey: Petrified Forest National Park.

PRINCIPAL INVESTIGATOR: W. E. Sudderth.

SPONSORING INSTITUTION: National Park Service, Western Archeological Center.

DATES OF FIELDWORK: November 10-14, 1975.

LOCATION OF SURVEY: This team did not survey in the normal archeological sense. They recorded and evaluated sites known by the park staff to have standing walls. All sites were in the southern half of the park.

PURPOSE OF PROJECT: The team recorded the sites as part of a national project to prepare a List of Classified Structures, which are those structures deemed worthy of preservation by the National Park Service because of historical, architectural, archeological or esthetic values. The team determined the level of significance of the structures, fixed a level of preservation treatment for them and provided a basis for planning and budgeting.

TECHNIQUES AND INTENSITY OF SURVEY: Because of the demands of time and money, as well as service directives, the team recorded only structures previously known to have visible multicoursed masonry. Sites were recorded on LCS forms developed for management purposes, as well as on archeological field forms and others developed by George Teague, lead archeologist. All sites were mapped to scale with tape and compass, photographed and marked on USGS topographic maps.

SUMMARY OF RESULTS: Six sites were recorded by the team. Site NA4725A is Navajo and dates to about AD 1750 on the basis of its architecture. It is adjacent to the BMII Flattop Site and sits on a spur of the mesa about 15 ft below the top. It contains an elongated (about 3 m) circular structure of unmodified sandstone slabs laid without mortar and has a narrow entryway 3 m long. Nearby are a possible storage cist, six bedrock mortars and a stone alignment that may be a water control feature. No new information was recorded at the Twin Buttes Site or the Puerco Ruin. The first map on record was made of Agate House. PEFO-LCS1 and PEFO-LCS2 are late pueblo single-room masonry structures. Both were constructed of roughly dressed sandstone blocks set in mud mortar. No other features or nearby sites were apparent, but PEFO-LCS1 was uncovered through wind and water action on an active dune that could contain more material. Both sites had a great many lithic and ceramic artifacts in the immediate vicinity. Both had been previously located but had not been mapped or adequately described by earlier surveys.

EVALUATION: The team clearly accomplished its stated purpose and provided additional usable information. With the exception of the Puerco Ruin, they provided the only known maps and photographs of the sites they recorded. The first reported Navajo site was recorded, as were specific plant identifications and their possible prehistoric uses. Because of time constraints, the final report is sometimes written in a misleading manner and other reports or original site forms should be consulted for site significance or ability to yield further information.

REPORTS:

Sudderth, W.E., Steve Adams, Robert L. Hall, Mary T. Morehead, Sonja Sanherb, George A. Teague and Marianne Trussell
1976 List of Classified Structures survey: Petrified Forest National Park. Manuscript on file Division of Adobe/Stone Conservation, Western Archeological Center, Tucson.

RECORDS: All site forms, maps, photographs, field notes and cost estimates for stabilization are on file at the Western Archeological Center, National Park Service, Tucson.

best copy available

PROJECT TITLE: Survey of Horse Pasture.

PRINCIPAL INVESTIGATOR: Barrie M. Thornton.

SPONSORING INSTITUTION: National Park Service, Western Archeological Center, Division of Internal Archeological Studies.

DATES OF FIELDWORK: December 20-22, 1976.

LOCATION OF SURVEY: The pasture is located in the southwest corner of Section 34, Township 17 N, Range 23 E. UTM boundary descriptions are:

Northing 601100	Easting 3853750
Northing 602200	Easting 3854000
Northing 601800	Easting 3853750
Northing 601800	Easting 3854000

PURPOSE OF SURVEY: To provide archeological clearance for a proposed 40-acre horse pasture next to the present stables area.

TECHNIQUES AND INTENSITY OF SURVEY: The two-person crew intensively (100 percent) covered the area in one day. The crew walked approximately 7 m apart and traversed back and forth over the entire area, using compass bearings to avoid recrossing previously surveyed areas.

SUMMARY OF RESULTS: Two lithic sites and one isolated artifact were recorded. Neither the cultural affiliation nor the time of occupation of the sites is known.

The first site measures 125 m by 250 m and is scattered across a shallow dry tank, or lake bed, that is 60 m in diameter and depressed only 30 to 50 cm below the surface. The scatter consists mainly of primary flakes, a few utilized flakes and large points, and a large number of cores. All the lithic material is petrified wood. The average density of the flakes is approximately 3 to 5 per meter. These are concentrated on a line 75 m wide, running north-south through the overall scatter. The cores are concentrated in the southern part of the dry lake bed at a density of 1 to 2 per meter. Three corrugated sherds and a bifacial mano fragment were found at the far northwest end of the scatter on a small rise. This rise forms the northern boundary of the lake bed and would be a suitable place for structures if habitation occurred at the site. No features could be found to substantiate this.

The second lithic site measures approximately 25 m^2. It consists of a highly concentrated area of primary flakes, a few of which show bifacial flaking. Density of the flakes is 25 to 50 per meter for the northern half of the scatter. The southern half has a low density of approximately 1 to 5 per meter. All the flakes are petrified wood. No other artifacts or features were found in association.

A large, unidentified, side-notched point was collected.

EVALUATION: Techniques of survey and recording are standard for good modern professionals. These are the first lithic sites recorded in the park.

REPORTS: Letter report, dated January 6, 1977, by Barrie Thornton. On file Western Archeological Center, NPS, Tucson.

COLLECTIONS: Western Archeological Center, NPS, Tucson.

PROJECT TITLE: Survey, Petrified Forest road widening, PEFO-78A (Pkg. 107, 128).

PRINCIPAL INVESTIGATOR: Nancy S. Hammack.

SPONSORING INSTITUTION: National Park Service, Western Archeological Center, Division of Internal Archeological Studies.

DATES OF FIELDWORK: July 10-21, 1978; 16 person-days.

LOCATION OF SURVEY: Two hundred feet on each side of Mainline Road south of Blue Mesa turnoff (12.5 miles) and 100 feet on each side of Blue Mesa Loop Road (3 miles).

PURPOSE OF PROJECT: Survey in advance of National Park Service road resurfacing project that would both widen the road and change the alignment in several places. This is the first part of scheduled survey for the roads project. The final part is scheduled for 1979.

TECHNIQUES AND INTENSITY OF SURVEY: 100 percent of described area was surveyed. Surveyors walked parallel on the same side of the road, approximately 100 ft apart, surveying in a zigzag pattern. All sites and isolated artifacts were flagged at the road, recorded, mapped, photographed and located on USGS map (1:62500). All sites, except those very obvious to the public, were staked and tagged. Two projectile points were mapped and collected. No other collections were made.

SUMMARY OF RESULTS: Hammack recorded 27 sites and six isolated artifacts. Six sites previously reported by Reed were more fully recorded by the survey crew. Sites were divided into six categories: lithic quarries, lithic scatters and chipping areas, Archaic, Basketmaker III, Pueblo I and II, and historic.

Lithic quarry sites were gigantic, at least a mile long and of undefined width. Two sites, one at Crystal Forest and the other at Jasper Forest, were recorded. Because both areas were commercially quarried in the late 19th and early 20th centuries, sites were defined on the basis of concentration of specific materials, existence of cores, and presence of bulb of percussion on flakes. Primary flakes predominated, with milky white petrified wood the preferred material. No sherds occurred on the sites.

Lithic scatters and chipping areas were characterized as small, definable areas of chipping activity that could not be related temporally or culturally. Four sites were recorded. Primary flakes and cores predominated, although secondary flakes and retouched tools occasionally were present. Both cherts from local cobbles in the desert pavement and petrified wood were used; one type or the other usually dominated. Sites were located in a variety of situations, including sand dune blowouts along major washes and mesa tops. Hammack suggests they may have been used as temporary campsites or as lookouts for game, or they may have been associated with nearby habitation sites.

Three Archaic sites and one isolated artifact were recorded. All were located within an eroded sand dune ridge reaching south from the Flattop area. Sites were aceramic but resembled Basketmaker III sites in every other way. They consisted of sandstone slab concentrations, hearths, small secondary flakes, and occasional sharp-angle thumbnail scrapers. Chert was the preferred lithic material. The isolated artifact was a San Jose style chert projectile point.

Basketmaker III sites were identified by the presence of Lino

Gray, Woodruff Brown, Lino Black-on-white, La Plata Black-on-white and White Mound Black-on-white. They are characterized by concentrations of sandstone slabs, separate concentrations of sherds and lithics, and trash eroding from drainages below the site. Complete features, such as sandstone slab house structures, cists and fire hearths, were recorded at two eroded sites. Alluvium deposits in the others prevented the location of features and exact site boundaries. With one exception, they are situated about ½ mi from Dry Wash and its tributaries on gently rolling alluvial hills or in sand dunes, always beneath the brow of the hill, with south or east exposure preferred. Ground stone was rare. Hammerstones made of petrified wood cores were diagnostic.

With 10 sites recorded, the combined PI-PII sites were the most numerous and included the greatest variety of site types. Definitive ceramics included Holbrook Black-on-white, polished smudged wares, gray corrugated wares, Lino Gray and Woodruff Brown. The majority were 1 to 2-room masonry structures, associated trash mounds and possible kiva-pithouses, but they also included a pot break, a sherd and lithic scatter and a probable field house. Masonry usually was of sandstone, with occasional pieces of petrified wood incorporated, but structures on two sites near Agate House were constructed of petrified wood chunks. Sites were situated closer to drainages than were BMIII sites and in less sheltered positions. Petrified wood was the preferred material for chipped lithics, unlike the situation in the BMIII and Archaic sites. Ground stone was more frequent and mainly manufactured from a coarse red sandstone of unknown origin. Petrified wood core-hammerstones were common.

The single historic site was a small sandstone block foundation across the road from Agate Bridge. Near it was historic trash from the first half of the 20th century. The trash probably is related to the early monument period, when the superintendent's house was located at Agate Bridge.

Hammack makes several observations concerning various aspects of the archeology: (1) As mentioned in the text of this report, there are two major directions of drainage within the park and only the southernmost area of the park drains to the south. In this area, Hammack found no Basketmaker III sites and believes there are none. A recheck of Reed's sites reinforces her opinion. (2) There was a definite lack of ground stone artifacts associated with Basketmaker sites, but ground stone did occur on PI-PII sites. (3) Preferred lithic choice during the Archaic and Basketmaker periods was chert; preferred material during PI and PII was petrified wood. (4) During PI-PII no Lino Gray occurs in the southernmost sites, but this type continues in the more northern sites. (5) Throughout the survey area isolated flakes and tools occur. (6) Site location varies from period to period.

EVALUATION: Hammack provided excellent data both for "pure" archeological purposes and for cultural resource management. All strategies, techniques and data categories meet current standards. Her observations concerning lithic choices, ceramic location, settlement pattern and diagnostic tools are astute, particularly since she conducted only a small linear survey; supporting data should be acquired on further surveys.

REPORTS AND PUBLICATIONS:

Hammack, Nancy, S.
1978 Archeological clearance survey report. On file Division of Internal Archeological Studies, Western Archeological Center, NPS, Tucson.

LOCATION OF COLLECTIONS, FIELD RECORDS, MANUSCRIPTS: All collections, field records, manuscripts, photographs and reports are located at the Western Archeological Center, NPS, Tucson.

Appendix II

SPECIAL REPORT ON REVIEW OF ARCHEOLOGICAL SURVEY POTSHERD COLLECTIONS, PETRIFIED FOREST NATIONAL MONUMENT, ARIZONA

(Manuscript on file Western Archeological Center, Tucson, Arizona)

by
Erik K. Reed
Regional Archeologist
National Park Service
Region Three

Santa Fe, New Mexico
March 1947

INTRODUCTION

In late January and early February 1947, the present writer reviewed rapidly about 340 sherd collections at Petrified Forest National Monument which had been gathered from 280 sites in 1941 and 1942 in the archeological survey of that area. Ninety small collections in the Park Naturalist's office remain to be classified and listed.

Each sherd collection was inspected; and the types of pottery recognized, together with any special remarks, were noted on an 8" x 5" card, with the site number. Most of the collections (170, representing 152 different sites) were resacked and taken to the Museum of Northern Arizona for more detailed study by Dr. Harold S. Colton. Twenty-eight collections typical of the several successive periods were retained at Petrified Forest National Monument. Several of these have the same site numbers as collections deposited at the Museum of Northern Arizona. One hundred forty-one collections were broken up, unusual sherds and good typical sherds being retained in a type collection at the monument; nondescript sherds, and, usually, the brown corrugated, being discarded. Of these, 35 duplicate site collections were taken to the Museum of Northern Arizona, and a few duplicate site collections retained as such. The 100 site collections broken up and largely discarded were small lots not showing anything of special interest.

This report summarizes and discusses the information gained from the rapid survey I made of these sherd collections, as noted on a file of 8" x 5" cards. There may be discrepancies and errors due to preparing this report at second-hand, from my notes, without having recourse to the pottery itself to recheck uncertain points, in addition to any mistakes inherent in my handling and interpretation of the material.

In the next section of this report, I list the pottery types represented, with brief characterization of each and with remarks on the time or associations and significance or relationships of each. This is all based mainly on the published work of others and my own general experience and ideas, rather than being primarily based directly on the Petrified Forest material itself.

The main portion of this report is concerned with allocation of sites to periods on the basis of pottery types in the sherd collections.

The section "DISCUSSION" takes up various points of interest in the ceramic sequence, compares the several horizons, or periods, to material of approximately similar date in adjacent districts, and gives a summary outline of the sequence.

In the appendix, all site collections handled are listed serially, with indication of the horizon to which each pertains and of disposal of each.

The findings of this rather sketchy study are in general much the same as those of Dr. H. P. Mera 13 years ago on the basis of 87 site collections within the Petrified Forest, and 22 more in the same district outside the monument boundaries. As outlined in Dr. Mera's 1934 report, occupation of the Petrified Forest extended from a very early phase, characterized by a distinctive type of coarse, brownish pottery, through a period of at least 700 years, to a final phase in the 14th century characterized by a wide variety of types of painted pottery, largely imported from the Hopi, Zuni, and White Mountain districts.

These sherd collections, however, include a larger number of sites of the earliest periods, and place them on a firmer basis; and also the larger number of "Pueblo III" sites permits an attempt at subdivision of that period into two or more separate horizons. The rarity of "Pueblo I" pottery in the Petrified Forest is even more strikingly brought out by review of this large series of collections than by Mera's work.

CLASSIFICATION OF POTTERY

The pottery comprises six general groups: plain smooth brown (varying in shade from black to buff and almost red); corrugated brown; plain rough white or gray; corrugated gray (not common); black-on-white; and black-on-red or -orange, and polychrome (three-color, generally black and white paints on a red base). Each of these broad classifications consists of several distinct types, in each of which the materials and techniques as well as the outward characteristics are more or less unitary and distinctive. These pottery types are already recognized and named, and have been described in print.

Although many of the potsherds reviewed do not correspond exactly to the types as they have been defined, no new types have been established from this preliminary study. Variants and unidentified sherds have merely been noted on the cards. More detailed study of the collections will clarify much of the uncertain material, and may change many of my rather hasty and general identifications, particularly in the black-on-white group. Several new types or varieties--hitherto unrecognized deviations--are to be expected but are of minor importance.

The known pottery types of the Petrified Forest district are grouped broadly by ware in the following listing. References cite Mera's study of the 1934 survey of the same district, and certain compilations of pottery-type descriptions, omitting many original references to certain types and omitting major studies of certain types such as, e.g., Haury's discussions of Four Mile Polychrome.

ADAMANA BROWN: Coarse, thick, "micaceous," grayish or light brown; smooth but not polished, paddle-and-anvil marks; believed to be very early. Mera 1934: 4.

WOODRUFF BROWN: Thinner and less coarse, without the white crystalline temper, without paddle-and-anvil depressions; smooth, sand-tempered, light brown or reddish tan, with subtypes: Vessel interiors (mostly bowls) SMUDGED black, or polished slipped RED;

very rarely (exteriors) INCISED. Associated with Lino White and with later types. Mera 1934: 6-7.

SHOWLOW SMUDGED AND CORRUGATED SMUDGED: Rather thin sand-tempered bowls with smudged and polished glassy black interiors and polished slipped reddish-brown exteriors; of Pueblo II and Pueblo III associations. Mera 1934: 12-13.

SHOWLOW BLACK-ON-RED: Another development of Woodruff Brown, bowls with a thin pinkish-red slip (like the subtype Woodruff Red), decorated, generally in broad-line designs, with a dull black (carbon) paint. Subtype with the slipped and polished reddish-brown exterior given indented-coil treatment instead of smooth, SHOWLOW BLACK-ON-RED CORRUGATED. Of Pueblo II and Pueblo III associations. Gladwin 1931: 27; Mera 1934: 12; Colton and Hargrave 1937: 79.

PINTO POLYCHROME: A late Pueblo III development from Showlow Black/Red; bowls with the interior covered with a thin whitish slip, decorated in weak black paint (carbon); red-brown exteriors. Nowhere very abundant. Gladwin 1930: 4-5; Mera 1934: 15; Colton and Hargrave 1937: 87-88.

GILA POLYCHROME: An early Pueblo IV development from Pinto, the characteristic decorated pottery of southern Arizona in the 14th century, abundant south of the Salt River but not common in the north (the Little Colorado drainage). Slip and paint much stronger than Pinto, design layout and motifs different, utilizing mainly solid elements, less use of hachure. Colton and Hargrave 1937: 88-89.

HOMOLOVI POLYCHROME: A separate development in early Pueblo IV from the Woodruff-Showlow line; the same soft and friable paste, mainly sand-tempered; poorly finished; a thin pinkish or tan slip, designs in weak black paint outlined with narrow white lines. Subtypes at Homolovi (Winslow), Chaves Pass, and Wallace Tank have been given separate names, e.g., "Black Ax," on the basis of yellowish or reddish slip color and other minor distinctions, but staying within the general definition of the Homolovi type and not meriting separate status. Material lacking the white outlining constitutes a valid subtype, HOMOLOVI BLACK-ON-RED. Mera 1934: 17-18; Colton and Hargrave 1937:81-85, 139.

HOLBROOK CORRUGATED: General term for the abundant dark-brown utility pottery, tempered with ground up potsherds; variety of treatment--ribbed or indented or semiobliterated corrugations; of Pueblo II and III associations. Mera 1934: 10.

HOMOLOVI CORRUGATED: Although the brown utility pottery comprehended under the name "Holbrook" seems to continue into initial Pueblo IV, much of the indented-corrugated of the latest horizon is light-colored, tan or pinkish. Mera 1934: 21; Colton and Hargrave 1937: 134.

McDONALD CORRUGATED: Deep bowls with polished smudged interiors (gray or black); white painted lines on polished corrugated brown exteriors. Uncommon type. Mera 1934: 16; Colton and Hargrave 1937:61-68.

PINEDALE BLACK-ON-RED and POLYCHROME: A late Pueblo III-early Pueblo IV development in the White Mountains in the Wingate-St. Johns tradition; bowls with black glaze paint on bright orange-red polished slip, bold style of decoration inside and out; exterior decoration usually outlined in white. Gladwin 1931: 41; Mera 1934: 16; Colton and Hargrave 1937: 106-108.

FOUR MILE POLYCHROME: A development from the Pinedale type in the middle half of the 14th century; bright dark-red surface, bowl interiors with black glaze designs outlined in white, bowl exteriors with a zone or band of black and white decoration; jars with black and white paint combined. Gladwin 1931: 43; Mera 1934: 20; Colton and Hargrave 1937: 109.

HESHOTA-UTHLA POLYCHROME (glaze-on-red interior, narrow-line white decoration on red exterior, resembling St. Johns) and the later ZUNI GLAZES (with white slip on interior and/or exterior, decoration in glaze and/or red or white): Several varieties of Zuni pottery of the 14th century occur in the latest horizon at Petrified Forest.

PLAIN POLISHED RED (UNNAMED TYPE): Similar to that found in the Zuni country and the White Mountains (e.g., Kinishba, by which name of a major excavated site the material might well be called) as the utility pottery of Pueblo IV.

KLAGETCH BLACK-ON-ORANGE and POLYCHROME: A development of St. Johns datable to the second half of the 13th century (the Kintiel focus, or phase, upper Puerco drainage). Buff or grayish to orange-white, the black decoration ranging from dull and brownish to strong and glossy. White exterior stripes often lacking. The "Kintiel" subtype is not readily distinguishable. Mera 1934: 17; Colton and Hargrave 1937: 123-127; cf. Reed 1944.

JEDDITO BLACK-ON-ORANGE and POLYCHROME: Similar to the Klagetch group, and in fact its westerly equivalent in the Hopi country and the Winslow area. Distinguished from Klagetch by predominance of fine quartz sand over ground-up sherds in the temper, redder orange surface color, lack of a distinct slip, somewhat different style of design. The "Tuwiuca" subtype is virtually indistinguishable. Mera 1934: 20; Colton and Hargrave 1937: 137-139 and 141-143.

JEDDITO BLACK-ON-YELLOW: The distinctive and familiar Hopi painted pottery of the 14th century. No visible temper, very fine texture; smooth polished yellow surfaces (cream-colored to orange brown); decoration in clear black or brown (manganese paint), often on bowl exteriors as well as interiors. Mera 1934: 21; Colton and Hargrave 1937: 151.

The precise origins of Jeddito Black/Yellow are debatable, but it clearly owes something to the orange types of the late 13th century of the Little Colorado area from Kintiel to Winslow mentioned above. It seems to be, however, largely derived from black-on-white traditions. Later, polychrome developments of Hopi yellow ware do not appear in the Petrified Forest collections, although W. Hough illustrates, in the Annual Report of the U.S. National Museum for 1901, 1903, Plate 60: b, a jar of the Sikyatki Polychrome type apparently from Wallace Tank.

JEDDITO CORRUGATED: Fourteenth century utility type accompanying Jeddito Black/Yellow, essentially Tusayan Corrugated (which is gray ware) fired in an oxidizing atmosphere, probably due to the use of coal.

LINO WHITE: The local form, in the Puerco drainage, of the familiar northern Basketmaker III pottery "Lino Gray." Distinctively coarse and rough, tempered rather liberally with large grains of sand, entirely unsmoothed and notably white in color, this variety requires, I believe, at least sybtype status. Mera 1934: 7; cf. Reed 1944: 164.

KANAA GRAY: Gray pitchers with the neck coils unobliterated are notably rare in these collections, although Mera reports the type as fairly common in his survey. (In reviewing his sherd collections at the Laboratory of Anthropology, I found only a few.) Subtypes of this diagnostic Pueblo I pottery of the ninth century include particularly MEDICINE GRAY of 875 or 900 to about 950, in which the unobliterated neck coils are indented-corrugated.

TUSAYAN CORRUGATED: The all-over indented utility pottery of Pueblo II and Pueblo III in northern Arizona (time range something like 925-1275 AD). Light gray and sand-tempered like the antecedent Lino and Kanaa utility types. Rare in the Petrified Forest district.

LITTLE COLORADO CORRUGATED: Identical with the more widespread Tusayan type of the north except for the tempering of ground-up potsherds (Colton and Hargrave 1937: 232-233). Almost as uncommon in the Petrified Forest as is the Tusayan type, but apparently characteristic in the northeastern drainage of the Little Colorado (Colton and Hargrave, loc. cit., and cf. Reed 1944: 165-166) and the Winslow district (Colton 1939: 67-68).

BASKETMAKER III TYPES OF BLACK-ON-WHITE: The three or more kinds of northern decorated pottery of the eighth century, and earlier, cannot always be readily and positively separated. This material consists of Lino Gray (or White) bowls with the interiors smooth and decorated with simple designs in black. The western type with carbon paint is called LINO, the eastern with iron paint LA PLATA. Both occur in the Puerco drainage, the iron-paint type more commonly. WHITE MOUND BLACK-ON-WHITE, a late form of the iron-paint type transitional to Pueblo I, is distinguished by better finish and more advanced designs.

PUEBLO I TYPES OF BLACK-ON-WHITE: Three types of the period 750-900, somewhat more easily distinguishable, appear in the Puerco drainage: KANAA with carbon paint and sand temper; DEAD RIVER, with sherd temper and distinctive "Little Colorado" slip (Mera 1934: 8; Colton and Hargrave 1937: 235); and KIATUTHLANNA, with iron paint and crushed-rock temper.

HOLBROOK BLACK-ON-WHITE: The most characteristic and abundant single type of painted pottery in the Petrified Forest; not common west of Winslow or in the upper Puerco drainage. Carbon paint, sherd temper, characteristic Little Colorado slip, designs of broad lines and solid triangles, often with pendant dots; also in bold "Sosi" style (see below). Mera 1934: 9; Colton and Hargrave 1937: 235-236.

BLACK MESA BLACK-ON-WHITE: Same style of design and same kind of paint; sand temper and no distinct slip. The typical Pueblo II painted pottery of northern Arizona, dated 860-1060 AD; not common in the Petrified Forest. Colton and Hargrave 1937: 208-209.

CORDON BLACK-ON-WHITE: Same style of design, iron paint. White Mountain district. Apparently not abundant in the Puerco drainage. Colton 1941: 59-60.

PUERCO and CHAMBERS-GALLUP BLACK-ON-WHITE: The abundant Chaco-like black-on-white of the Puerco drainage in Pueblo II-III (pottery with white core and surface, no distinct slip, sand and sherd temper, iron paint); includes solid-element style of design (one definition of Puerco Black/White; another is longitudinal hachure), and hachure-filled decoration (Chambers, with sand temper; or Gallup, with sherd temper), and combinations of these two kinds of designs (not separately named). I have grouped this material generally under the less specific name "Puerco." Gladwin 1931: 24; Mera 1934:9; Colton 1941: 57-58.

SOSI and DOGOSZHI BLACK-ON-WHITE: The western or Kayenta-Tusayan types, with sand temper and carbon paint, in the first half of the 12th century; decorated respectively with bold solid elements (triangles, steps or terraces, heavy barbed lines, no pendant dots) and hachure-filled designs (Chaco style), apparently never combined as in Puerco Black/White. Colton and Hargrave 1937: 209-213.

SNOWFLAKE BLACK-ON-WHITE: Dense iron paint on polished white slip, Sosi style; sand temper. White Mountains district, 12th century. Colton 1941: 62-63.

TULAROSA BLACK-ON-WHITE and subtypes RESERVE (thin; early); CHETA (crude, 11th or early 12th century); WHIPPLE (intermediate quality, into 12th-early 13th century); and ROOSEVELT (western form of well-developed Tularosa, 13th century; differences in design layout and certain decorative motifs). Balanced and interlocking solid and hachured design elements; generally with slip, sherd temper, iron paint. Mera 1934: 14; Colton and Hargrave 1937: 240-241; Colton 1941: 61, 63-64.

The lines of demarcation between subtypes of Tularosa pottery are not clear to me. Much of what I have included under Puerco Black/White is more or less in the Tularosa style and perhaps should be referred to the Cheta type.

PINEDALE and KLAGETCH BLACK-ON-WHITE: Late developments of Tularosa Black/White in the last part of the 13th century, localized respectively in the White Mountains and the Kintiel focus, but practically indistinguishable. Dense black paint, white slip, sherd temper; same style of design as Klagetch Polychrome (much as Tularosa Black/White and St. Johns Polychrome share a single design system, found also on much Mesa Verde Black-on-white). Colton and Hargrave 1937: 241-244; cf. Reed 1944: 168.

PADRE BLACK-ON-WHITE: The same body (paste, temper, slip, paint) as Holbrook, with hachure-filled designs (the Chaco or Dogoszhi style). Colton and Hargrave, 1937: 236-237.

WALNUT BLACK-ON-WHITE: The same, with the more advanced and complex design system known as "Tusayan style." Dated at 1125-1275 AD. Mera, 1934: 13; Colton and Hargrave 1937: 237-240.

FLAGSTAFF BLACK-ON-WHITE: Carbon paint, sand temper, Tusayan style of design, dated 1125-1225 AD; rare in the Petrified Forest district.

A major group of Anasazi pottery which is common in northeastern Arizona and the Flagstaff district but almost entirely lacking in the Petrified Forest is San Juan Orangeware. Deadmans Black-on-red (860 or earlier-about 1060 AD) and Tusayan Black-on-red (1060-about 1150 AD) are unknown here, but a few sherds occur of TUSAYAN POLYCHROME (Black and red on unslipped orange; dated, including the Citadel subtype, to 1075-1250 AD) and KAYENTA POLYCHROME (similar, with the addition of white outlining; second half of the 13th century).

CLASSIFICATION OF SITES

The sherd collections may be classified in the following groups:

Adamana Horizon

13 pure sites of Adamana Brown: Nos. 7, 25 A-E, 29, 40, 41, 43, 44, 113, 166, 203, 213, 216, 230.

Two of these include one late B/W sherd each, and two a brown corrugated sherd apiece, considered to be strays of no significance.

2 sites predominantly Adamana, but with significant representation of Woodruff Brown and a few Lino White or La Plata B/W: Nos. 203, 130.

There are indications of Adamana components in a number of the Pueblo II and Pueblo III sites, as listed below.

Lino-Woodruff Period

4 sites with predominance of brownware over white: Nos. 93, 94, 98, 142.

9 sites about 30-50, or predominance of Lino White, but no painted pottery: Nos. 50, 60, 116, 121, 122, 148, 149, 176, 209.

25 sites predominantly Lino (less than one-third Woodruff), with a little La Plata or White Mound B/W: Nos. 52, 53, 54, 56, 59, 73, 107, 108, 109, 115, 123, 126, 128, 143, 150, 180-184, 200, 219, 220, 251, 252.

1 such site, No. 120, with several early Pueblo III B/W sherds but no corrugated; primarily a Lino-Woodruff site with a possible later component.

8 sites predominantly Lino (none to considerable Woodruff), with Pueblo I types of black-on-white but no evidence of Kanaa Gray (Pueblo I coil-neck pitchers): Nos. A145, A146, 221, 249, 250, 253, 264, 265.

1 site, No. 18, with Pueblo I B/W and Medicine Gray or its equivalent in brownware paste (indented-corrugated neck), also Lino White and a typical thick, coarse, grayish Woodruff Brown.

1 site, No. 257, with both Lino White and a smoother plain gray, like typical northern Lino, which might be from the bodies of banded-neck pitchers, and one sherd of clapboard-coil gray which is probably a Kanaa neck; a few Woodruff

Brown. No Basketmaker III or Pueblo I B/W. Continued occupation, a component of the next period, also indicated--Holbrook B/W and Puerco B/W; but no corrugated brown in the collection.

In a few of the "pure" Lino-Woodruff sites there is an occasional late B/W or corrugated brown stray sherd from Pueblo II or III, probably due to chance or drift.

There are also Lino-Woodruff components in sites with later occupations as listed below.

Holbrook Period, or "Pueblo II"

Characterized by Holbrook B/W, Puerco and Cheta and Chambers-Gallup B/W; occasional Black Mesa, Gordon and Snowflake B/W; brown indented-corrugated (Holbrook Corrugated), plus occasional Little Colorado Corrugated (gray); Showlow Black-on-Red and Smudged, with corrugated subtypes, and occasionally Woodruff Red.

54 [sic] pure sites, with pottery of Holbrook-period types only (in a few, no Holbrook B/W but only Puerco and/or Cheta or only Snowflake B/W; in some, no representation of the Showlow types). No Wingate Black/Red: Nos. 2-LA 526, 4-LA 1390, 32, 36, 48, 87, 133, 136, 137, 145, 155, 157, 158, 159, 161, 162, 168, 174, 177, 179, 188, 189, 190, 196, 207, 210, 222, 225, 227, 228, 234, 241, 244, 248, 261, 262, 270, 274, 275, 276, 280, 282, 283, 286, 289, 290, 296, 297, 298, 301, 302, 303, 305.

Sites of the Holbrook period with earlier components as indicated:

3 plus Adamana: Nos. 8, 14, 15.

13 plus Woodruff Brown only: Nos. 17, 46, 72, 88, 89, 130, 140, 144, 146, 231, 238, 239, 277.

10 plus Lino White, not Woodruff Brown, often plus Basketmaker III or Pueblo I B/W: Nos. 33, 93, 103, 104, 131, 137, 153, 154, 173, 254.

11 with both Lino and Woodruff: Nos. 62, 70, 75, 151, 170, 186, 201, 206, 215, 223, 242-43.

2 with both Lino-Woodruff and Adamana components indicated: Nos. 83 and 132.

These sites with Lino and early B/W or Lino and Woodruff (as fairly definite components, not merely single sherds) probably represent continued occupation from the eighth or ninth century to the eleventh. For the three sites with Adamana and Holbrook components but not Lino-Woodruff, separate occupations of the same site at least 200 years apart are suggested.

As the distinctive type Wingate Black/Red is rare in Holbrook period sites, and fairly common in "Pueblo III;" it probably appeared only in the eleventh century. There are Holbrook-period sites, with the complex of types indicated above, plus Wingate B/R. Most of these sites show a few Lino and/or Woodruff sherds, but not enough to indicate a definite component. Seven such sites: Nos. 79, 102, 165, 167, 191, 199, 272.

Walnut Horizon (Early "Pueblo III")

Holbrook-Walnut B/W of Sosi style of design, Padre B/W (Dogoszhi style), and Walnut B/W; varieties of Tularosa B/W, including Roosevelt and probably Whipple; brown (Holbrook) corrugated; Wingate B/Red, and occasionally Houck Polychrome; the Showlow group and Woodruff Red.

In a few of these sites, varieties of Tularosa B/W preponderate, with little or no Holbrook-Walnut present in the collection. In quite a few, there is no Wingate.

33 [sic] sites correspond fairly well to this complex: Nos. 82, 92, 260, 269, 287, 291, 192, 192, 97, 64, 16, 67, 2-not LA 526, 4-LA 1444, 23, 27, 63, 67, 139, 90, 141, 194, 160, 185, 187, 195, 197, 211, 214, 217, 233, 271, 285, 307.

In many of these sites, Holbrook B/W and Puerco B/W are present; whether or not separate "components" are indicated is difficult to establish, since the brown corrugated is the same, the Showlow series occurs in both horizons, and Wingate B/R is known in Holbrook sites lacking 12th century types. In the listing I have therefore made no distinction on this basis, assuming that Walnut sites with Holbrook B/W or Puerco B/W were occupied from late in the Holbrook period continuously into the 12th century.

2 sites of the Walnut horizon with Adamana components but not Lino-Woodruff: Nos. 84, 255.

7 with Lino-Woodruff components, rather sparsely indicated: Nos. 125, 235, 56, 106, 273, 133, 223--in each case with a Holbrook occupation suggested but not clearly distinguishable.

4 with both Lino-Woodruff and Adamana pottery as well as Hol-

brook-Walnut: Nos. 212 (which is predominantly Holbrook with very little Woodruff), 147, 129, 68.

1 collection, site No. 240, comprises a few Walnut B/W and Puerco B/W, a few gray indented-corrugated and clapboard-coil.

Tularosa-St. Johns Horizon (later Pueblo III)

Wingate B/R and Tularosa B/W (the fully developed type, and perhaps also the Whipple subtype) and Pinedale B/W, preponderating over Walnut B/W; St. Johns Polychrome, Querino Polychrome, Klagetch Polychrome; Pinto Polychrome, occasionally Homolovi Polychrome; occasionally Pinedale B/R and Polychrome, brown corrugated still unchanged from the Holbrook type; McDonald Corrugated; gray corrugated types (Tusayan and Little Colorado) less rare than before. Apparently the Showlow series, including even plain Woodruff Red, continued in use; sherds of Showlow B/R, less often of other types of this group, occur not only frequently in sites with Holbrook and/or Walnut components, but sometimes in collections with Tularosa B/W and St. Johns and/or Pinto Polychrome, no Walnut B/W or earlier pottery.

11 sites seem to be of this horizon only, with or without Walnut B/W (and occasional Padre B/W): Nos. 1-LA 469, 26, 113, 127, 129, 134, 135, 152, 178, 232, 306.

6 sites are Pueblo II and III (Holbrook and Walnut and Tularosa-St. Johns): Nos. 22, 105, 118, 205 (the B/W early, no definite Tularosa, but Pinto Polychrome Nos. 278, 288).

1 site, No. 198, predominantly Holbrook, the late component consisting of Pinedale B/W and yellow blind-corrugated cf.

Jeddito.

5 Tularosa-St. Johns sites, with or without Holbrook and Walnut components, in which Lino-Woodruff components are indicated: Nos. 21 (with also an Adamana component), 30, 66 (late component sparse, B/W largely Pueblo I and II), 76, 119.

Possibly the general Pueblo III period should be still further subdivided, on the basis of further study, separating off a horizon of the second half of the 13th century, formed by Pinedale-Klagetch Black-on-White and Klagetch-Kintiel Polychrome, in which should fall also Jeddito-Tuwiuca Black-on-Orange, Homolovi Polychrome, and Pinedale Black-on-Red and Polychrome. This is not as readily apparent from review of these site collections; in other words, we lack pure sites of this level in the continuous development.

Initial Pueblo IV

Finally there are six collections containing early Pueblo IV pottery types and representing sites occupied in or into the 14th century, the local form of the Homolovi focus.

Three of these consist of only a very little pottery: No. 171 (the small cave excavated by Gale in 1941--a sherd of Homolovi Polychrome, two unidentified sherds); No. 163 (a few pieces of Pinedale Black-on-Red and Four Mile Polychrome); No. 169 (Pinto Polychrome, Homolovi Polychrome, and brown corrugated; this could, despite the lack of B/W sherds, be terminal Pueblo III instead of early IV).

Two are large and well-known sites: the Puerco Ruin (LA 520), and Stone Axe Ruin at Wallace Tank (FF 237, LA 1312, NA 1023). Both collections consist almost entirely of 14th century types. The following occur in both: Gila Polychrome, Jeddito Black-on-Yellow, Homolovi Polychrome, brown and Homolovi Corrugated, plain polished red. There is a single sherd of Jeddito Corrugated (yellow) in the Puerco Ruin collection. Additional 14th century types at Wallace Tank, not represented in this particular small collection from Puerco Ruin, include Four Mile Polychrome, Pinedale Polychrome, and the Zuni Glazes. Late 13th century types from Wallace Tank include Pinedale B/W and Klagetch Polychrome, Tularosa B/W and St. Johns Polychrome, Jeddito-Tuwiuca Black-on-Orange, and Pinto Polychrome. The Pueblo III types Walnut Black-on-White and Tusayan Corrugated (gray) appear sparsely in both collections.

Site 69 corresponds almost exactly to Wallace Tank, with the addition of a few earlier sherds: one each of Holbrook B/W, Puerco B/W, Showlow B/W Corrugated, and Lino White.

DISCUSSION

Adamana Brown is believed to constitute the oldest known ceramic horizon in this district, representing a very early cultural stage. This view is based on its occurrence, mainly as "pure sites," its association with circles of slabs indicating a comparatively primitive type of dwelling, and with a simple type of oval bowl metate (Mera 1934: 2), and on the primitive qualities of the pottery itself. The occurrence of collections consisting of this type only shows that it comes either before or after all the rest, separate from the sequence of Puebloan painted and corrugated pottery. That it is earlier, rather than later, seems more likely, especially since there are a few sites with both Adamana and Lino-Woodruff pottery, the second group being datable to a quite early period. This is confirmed by the circumstances of the one reported occurrence of Adamana Brown outside the Petrified Forest district. Several sherds were found in the "Bear Ruin" at Forestdale, 50 miles south of the Petrified Forest, in a phase or horizon dated to the 7th and 8th centuries (Haury 1940: 79-80).

In tabulations of successive foci of various districts of northern Arizona, Dr. Colton lists the Adamana focus at the Pueblo

I time level, or 730-900 AD. This cannot be right. The succeeding Woodruff focus (not listed by Colton) is certainly no later than that, and evidently runs somewhat earlier; Adamana Brown was made and used in Basketmaker III times, and probably had been superseded by 750 AD.

The flecks of white which are conspicuous as temper in the paste of Adamana pottery have previously been referred to, almost automatically, as "mica." (The shiny particles in Hohokam and Prescott pottery, are, I believe, actually mica.) Now, mica is not known to occur in the Petrified Forest, while selenite is abundant here. Simple mineralogical tests performed by Park Naturalist Keller were inconclusive but tended to suggest that the white material is not selenite (gypsum); however, Colton (1941: 34) refers to it as "soft white crystalline material suggesting gypsum." I suspect that more thorough tests than we were able to perform would indeed show the white crystalline material to be selenite. If so, this would be strong confirmatory evidence of local manufacture entirely within the Petrified Forest.

The period represented by Lino White and Woodruff Brown, with the addition of early black-on-white types at some sites, evidently is a long one corresponding to the latter part of Basketmaker III and Pueblo I, or from before 700 to around 900.

There are collections with no painted pottery, collections with a few black-on-white sherds of Basketmaker III types (White Mound, of the Puerco area, 750-800 AD, and the earlier La Plata type), and collections with a few of Pueblo I black-on-white of the 9th century. All these combine the hard, rough, white Lino pottery and the softer, smooth brownware of Woodruff type, but the former predominates strongly in the collections which include decorated sherds. In at least two of the few collections with preponderance of brownware, it is coarser and thicker than typical Woodruff; and in at lease one, a little Adamana occurs.

The possibility is suggested that, with changes in both technique and ceramic materials, Adamana Brown developed into the

Woodruff type (that is, that the same people kept on making pottery by the same method of firing, with consequent production of brown surfaces, learning new techniques and selecting different materials), and that about the time of this change, or immediately after it reached completion, hard white pottery of northern affiliation appeared in the district, increasing rapidly in proportion to the brownware; possibly at first no black-on-white accompanying the plain Lino, then a little standard Basketmaker III, then White Mound in the latter part of the 8th century, then Pueblo I types (Kanaa style) in the 9th century. Evidently the plain white, as well as Woodruff Brown, continued in use during Pueblo I times, as banded-neck gray is notably rare in the collections.

The virtual absence of Kanaa Gray and the distinctiveness of the local plain Lino (very white, with abundant and conspicuous temper) indicates that this Lino White was manufactured locally, at least in this general area. The possibility that only Woodruff Brown was locally made and the white pottery imported cannot be wholly discounted, but the reverse could equally well be true; and the production of both by the same group of people is not incredible. Evidently the makers of the Puerco variant of Lino, or Lino White, applied the same successive styles of painted decoration to a little of this pottery as their more northerly contemporaries used, perhaps inspired to do so through importing small amounts of Lino Black-on-Gray and La Plata Black-on-White, and, later, Kanaa Black-on-White and Kiatuthlanna Black-on-White. But they never adopted the banded-neck technique with grayware and imported very little of it. White Mound B/W is a localized type of the Puerco drainage, intermediate between La Plata and Kiatuthlanna. The type Dead River B/W, defined as pottery of the Holbrook-Walnut group (with characteristic paste, temper, slip), decorated in Kanaa (Pueblo I) style, is not common and scarcely constitutes a distinct horizon. Probably it does represent the beginning of the Holbrook-Walnut development, but it might have been made in early Pueblo II along with rather simple Holbrook.

That the Holbrook period also represents a considerable duration of time is suggested by the large number of sites and the relative abundance of the pottery types. A general dating for the period on the basis of comparison with other districts is 900-1100 AD. None of the individual pottery types of the Holbrook-Showlow complex are well dated, but in the Flagstaff area Holbrook B/W occurs as trade material at sites falling at the end of this period.

The fact that Wingate B/R is found at only a few sites of the Holbrook-Showlow complex is of interest, and of uncertain significance. Wingate B/R is generally thought to have appeared as early as 950 AD, but apparently it did not reach the Petrified Forest, at least, until a century or more later. The alternative explanation is that, instead of the Woodruff period extending through Pueblo I, the Holbrook period may have begun in the 9th century.

The Holbrook period in the Petrified Forest differs in at least one important respect from the Holbrook focus as defined by Colton (1939: 67) for the vicinity of Winslow. He lists as its diagnostics Holbrook B/W and Little Colorado Corrugated (reduced-fired gray). In the Petrified Forest, the corrugated pottery is almost entirely brownware. Probably, however, there are few major differences between the material from the Winslow district as a whole and that from the Petrified Forest, and perhaps a single focus or phase designation can be used to include both.

Possibly both Holbrook B/W and Puerco B/W were locally made. No doubt the abundant corrugated brown is local. The Showlow group comes from the White Mountains to the south, and probably so do Gordon and Snowflake B/W. The few sherds of Black Mesa B/W and Tusayan Corrugated are imports from the north. Those of Little Colorado Corrugated may represent trade with the Winslow district, or, more probably, other accidental or intentional and experimental firing of the local sherd-tempered corrugated vessels in a reducing atmosphere.

The first of the horizons belonging in, or compared to, the general Pueblo III period can be dated relatively closely and positively--to the 12th century, approximately. This is the Walnut Horizon, including Holbrook-Walnut of Sosi style and Padre B/W, as well as Walnut B/W, with Wingate Black-on-Red. It is dated on the basis of the first appearance of Walnut B/W in dated sites in the Flagstaff area; the dates of Sosi and Dogoszhi B/W (also established in the Flagstaff area); and the dates of later Pueblo III types. Again, this material corresponds to Colton's St. Joseph focus at Winslow except that he again gives Little Colorado Corrugated instead of brown utility pottery.

Second, the Tularosa-St. Johns horizon, with Pinto Polychrome, would fall in the 13th century, probably also late 12th, on the basis of decorated pottery types present. Sites with the yellow to brown Klagetch Black-on-orange variety of St. Johns Polychrome and the Pinedale (or Klagetch) variety of Tularosa B/W extend into the last quarter of the 13th century, correlating with Gladwin's Kintiel focus to the northeast (cf. Reed 1944) and Colton's Tuwiuca focus in the Winslow district.

The continuation through Pueblo III of several types equally characteristic of Pueblo II is seen: Holbrook Corrugated, the abundant utility pottery; the Showlow group, and even Woodruff Red. Probably at least Walnut B/W is locally made; most of the decorated types are definitely or very possibly imports.

In the final, or Homolovi, horizon, falling in initial Pueblo IV in the 14th century, Homolovi Polychrome is perhaps to be considered locally made. Probably it is the only painted type which was actually manufactured in the Winslow-Holbrook-Petrified Forest area of the middle Little Colorado. The utility ware, Holbrook-Homolovi Corrugated, is no doubt locally made. The other types listed are imports from several directions: glaze/red and glaze/white from the Zuni district; related polychrome redware (black-glaze and white paint) of Four Mile and Pinedale types and plain polished red from the White Mountains; Gila Polychrome from still further south; and yellow ware from the Hopi country to the north. Possibly the Homolovi Polychrome is actually trade from the Winslow direction, as it is not notably more abundant than these others.

The only major difference between this material and the pottery of the Homolovi focus is the preponderance of plain pinkish utility pottery over corrugated in the Winslow material (Colton 1939: 69).

In summary, the sequence of pottery types can be outlined as follows:

Adamana focus: Adamana Brown. Postulated transition to Woodruff Brown by about 700 AD.

Woodruff focus or period: Lino White and Woodruff Brown, including Smudged and Red subtypes, plus small amounts of black-on-white of Basketmaker III and Pueblo I types. From before 750 to at least 900 AD.

Holbrook period (Pueblo II): Holbrook, Cheta and Puerco B/W, Holbrook Corrugated; Showlow B/R and Smudged, with Corrugated subtypes. Wingate B/R appears during this period. Probably about 900-1100 AD.

Pueblo III: Walnut and Tularosa B/W, Wingate B/R and St. Johns Polychrome; Holbrook Corrugated and Showlow types; Pinto Polychrome. General period, approximately 1100-1300. Can be subdivided tentatively into three horizons, thus:

1. 12th century: Holbrook-Padre-Walnut B/W and Wingate B/R.
2. Between 1175 and 1275: Tularosa B/W, St. Johns and Pinto Polychromes.
3. Between 1250 and 1300: Pinedale and Klagetch types.

Homolovi period or horizon: Homolovi Polychrome, Gila Polychrome, Four Mile Polychrome, the Zuni glazes, Jeddito B/Yellow, Holbrook-Homolovi Corrugated. Falls between 1300 and 1400 AD.

REED'S APPENDIX

The site collections are listed serially below, with the horizon to which each pertains, and the disposal made of each, indicated by abbreviations, as follows:

Horizons: Ad--Adamana; L-W--Lino White and/or Woodruff Brown, with or without B/W; HK--Holbrook (Pueblo II); PIII--Walnut and/or Tularosa-St. Johns'; Hom--Homolovi (Initial Pueblo IV).

Disposal: A--deposited at the Museum of Northern Arizona; d--distributed in selections of typical and unusual sherds (retained at the monument), and/or discarded; r--retained at the monument as site collection.

In many cases there was more than one collection from the same site. Varying disposition of these is indicated by an appropriate formula--thus, A2d means that of three collections bearing the same number, two went to the Museum of Northern Arizona and one was broken up, or "distributed and discarded."

Site No.	Horizon	Disposal
1(LA 469)	PIII	A
2(LA 526)	HK	A,d
2(#3?)	PIII	A
4(LA 1390)	HK	A
4(LA 1444)	PIII	A
7	Ad (sp., seed jar)	r
8	HK, Ad	d
13	Ad, II or III	A
14	HK, Ad	A
15	HK, Ad	A
16	HK	A
17	HK	A
18	Pueblo I	A
21	PIII, a few plain brown W & Ad	A^2, d
22	PIII	A
23	PIII	r
25A-E	Ad	A^5
26	PIII	A^2
27	PIII	A^2, r
29	Ad	A
30	PIII	d
32	Prob. HK (a few indet B/W, brown corrug.)	d
33	HK	d
36	HK	d

Site No.	Horizon	Disposal
40	Ad	A
41	Ad	r
43	Ad	A
44	Ad	A
46	HK	A
48	HK	d
50	L-W	A
52	L-W	r
53	L-W	A
54	L-W	A
55	L-W, a smaller HK component	A
56	L-W	A
58	PIII and L-W components	A
59	L-W	A
60	L-W	A
62	HK	A
63	PIII	A
64	HK	d
66	HK, a few earlier(?) and later sherds	A
67	PIII	A
68	HK & PIII	A
69	Hom	A
70	HK	d
72	HK	d
73	L-W	A
75	HK	d
76	PIII	A
77	W and HK components	d
78	HK	d
80	HK and (smaller) L-W components; respectively	A, d
82	HK (and early PIII?)	A
83	HK	d
84	HK, a few Walnut B/W, a few Ad Brown	d
87	HK	A^{2}, d
88	HK	A
89	HK	A, d
90	HK and early PIII	A
91	L-W and HK	A
92	PIII (early)	A, d
93	L-W	A, r^{2}
94	L-W	d
95	HK	A
96	HK and L-W	A
97	HK, a few early PIII, and L-W components	A^{2}
98	L-W	A, r
99	L-W, a few HK in Lot 2	A, d
100	L-W, a few HK in Lot 2	A, d

Site No.	Horizon	Disposal
101	L-W, a few HK	A, small d
102	HK	d
103	HK	d
104	HK	d
105	PIII	A, r
106	HK	d
107	L-W (a stray Klagetch B/W sherd in each lot)	r, d
108	L-W	A
109	L-W	A, r
110	L-W and HK 3 lots divided:	A^3, d^2
111	W, a very few HK	A
112	L-W and HK	d
113	Ad	A
114	L-W and HK	d
115	L-W	d
116	L-W	r
117	L-W and HK	d
118	PIII	A, d
119	L-W, HK (separate component? few), and PIII	A^2, d
120	L-W, a few HK in Lot 2	A^2
121	L-W	A
122	L-W	A; E.W.H.
123	L-W	A, d
124	PIII (and L-W)	A, ?
125	HK (and L-W)	d
126	L-W	A, r
127	PIII	A
128	L-W (several White Mound; only 2 Woodruff)	d
129	PIII	d^2
129?	Probably HK	A
130	HK	d
130	Ad	A
131	HK	d
132	HK, a few L-W	A, d
133	HK	A, r
134	PIII	r
135	PIII	A, r
136	HK	d
137	HK	d
138	HK	A^2
139	HK and PIII	A, d
140	HK (?PII or early III; B/W is "Chota," no B/R)	d
141	PIII	A, r
142	W (pure Woodruff site? Sherds few.)	A
143	L-W	d

Site No.	Horizon	Disposal
144	HK	r
145	HK	d
A-145	L-W with PI B/W (and 1 sherd Hom-Chaves Pass Polychrome.)	A
146	HK	?, d
A-146	L-W with PI B/W (only 2 Woodruff sherds)	A
147	JK	A, d
A-147	L-W, 1 sherd Walnut B/W and 2 indet. B/W	d
148	L-W, 1 "black-on-white sherd	A
149	L-W	d
150	L-W (1 sherd White Mound; proportion L-W?)	?
151	HK, a few L-W	d, r
152	PIII	A, d
153	HK, a few early B/W	A, d
154	HK, a few early B/W	d^2
155	HK	d
156	HK	d^2
157	HK	d
158	HK	A, d
159	HK	?
160	Early PIII	A, d
161	HK	A, d
162	HK (the B/W is Puerco)	d^2
163	Hom (a few sherds; Pinedale & Four Mile)	d
164	HK (the B/W incl. Walnut)	d^2
165	HK	A, d
166	Ad	A, r
167	HK	A, d
168	HK	r^2
169	Hom (few; 1 plain gray)	d
170	HK (a few L-W)	d
171	Hom (5 sherds, poly. [Chaves Pass], B/W [indet.], plain gray)	d
172	Probably HK (3 sherds)	d
173	HK, a few L	d^2
174	HK	d
175	HK, a few L	d
176	L-W	d
177	HK	d^2
178	PIII	A, d
179	HK	A, d
180	L-W (virtually no Woodruff)	A, r
181	L-W (virtually no Woodruff)	A
182	L-W (very few brownware)	A, d
183	L-W	A^2
184	L-W (no Woodruff in Lot d; Lot A, 90 to 3)	A, d
185	PIII (Walnut B/W and brown corrug. only)	A, d
186	HK	A, d
187	PIII and HK, a few Pueblo I	A^3

Site No.	Horizon	Disposal
188	HK	A, r
189	HK	A, d
190	HK (few and misc.)	d
191	HK	A
192	HK (and into early PIII--Sosi style and Walnut B/W)	A
193	HK, Walnut B/W	d
194	HK (?-indet. B/W); black/corrug. brown in Lot d	A, d
195	Early PIII	A,
196	HK (?-few; indet. B/W)	d
197	Early PIII	A, d
198	HK (and 2 Hom-phase sherds)	A
199	HK	A
200	L-W (only 1 Woodruff Brown, r, in type coll.)	E.W.H.
201	HK, a very few L-W	A, d
202	HK, L-W	d^2
203	Ad (2 L-W, some Woodruff?)	A
204	Ad	r, E.W.H.
205	HK (1 Pinto Poly.)	A
206	HK	A^2
207	HK	d
208	HK (few sherds) and L-W (very few)	A
209	L-W (all Woodruff Smudged except 2 jar sherds)	d
210	HK	d
211	Early PIII	r, d
212	HK and Early PIII	A^2 or ^{3}
213	Ad	d
214	HK and Early PIII	r^2
215	HK, a few L-W	A
216	Ad (1 corrug. sherd)	A
217	Early PIII	d
218	A few HK Corrugated Brown	d
219	L-W	A
220	L-W (very few brown)	A, d
221	L-W, a few of HK	d
222	HK	d
223	HK (few; a few Lino)	d^2
224	A few Holbrook Corrugated Brown, 1 plain dark	d
225	HK	d^2
226	HK	d
227	HK	d
228	HK (few)	d
229	A few L-W and a few probably HK	d
230	Ad	A
231	HK	A^2

Site No.	Horizon	Disposal
232	PIII	A
233	Early PIII	A
234	HK	A
235	A Walnut B/W bowl, a few L-W	d
237	Hom (Wallace Tank)	r
238	HK	d
239	HK	d
240	Walnut and Puerco(?) B/W, 1 gray corrug., 1 Kana-a(?) gray	d
241	HK	A
242 & 243	HK	A
A-244	A few of HK	d
A-248	HK (and a few earlier sherds)	A
A-249	L-W, Dead River(?) B/W	?
A-250	L-W (only 2 Woodruff Brown)	d
A-251	Lino, one Showlow B/R	A
A-252	Lino (only white, 40)	d
A-253	L-W	A
A-254	Few L and HK	d
255	JK	A
257	PI? - L-W, HK B/W, 1 coil gray	d
258	L-W and HK	A
A-259	Few HK, a Kana-a B/W	d
A-260	HK	A
A-261	HK	r
A-262	A few Lino and HK B/W	d
A-263	HK, a Kana-a B/W	A
A-264	L-W and few HK	A
A-265	L-W and PI B/W	d
A-266	L-W and PI B/W	d
A-267	L, B/W Kana-a and HK	d
267-B	HK (a few PII B/W)	A
268	A few L-W, a Kana-a B/W, a few HK	d
A-269	HK (and Walnut B/W)	A
270	HK	d
A-271	Early PIII	A
272	HK	A
273	PI?	d
274	HK	A
275	HK	d
A-276	HK (few)	D
277	HK	A[2]
278	Few HK-Early PIII (1 Tularosa; 1 St. Johns)	d
280	HK	A
281	(indet. B/W and Little Colorado Corrug.)	A
282	HK	A
283	HK (1 Wup. B/W; 1 mod. Hopi)	?
284	Brown corrug.; Woodruff	d

Site No.	Horizon	Disposal
285	PIII	A
286	HK	A
287	HK	A
288	PIII	A
289	HK (B/W uncertain)	A
290	(1 Roosevelt? B/W; 1 Kana-a) Black Mesa, 1 W. Smudged	d
291	Early PIII	d
292	HK	A
293	Ad (plus several corrug.; 1 W.-S. sherd)	d
294	(3 brown corrug.)	d
296	HK (B/W only)	d
297	(1 Lino; 3 Chaco 2; 3 indet. Little Colorado)	d
298	HK (only B/W)	d
299	(a few Black Mesa focus sherds; 1 Smudged)	A
300	Woodruff Brown and brown corrug.	A
301	HK	d
302	HK	d
303	HK	d
304	A gray corrug. small jar	d
"305"	HK	A
"306"	PIII	?
"307" (LA 520, Puerco Ruin)	Hom	r
?	Early PIII	d

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